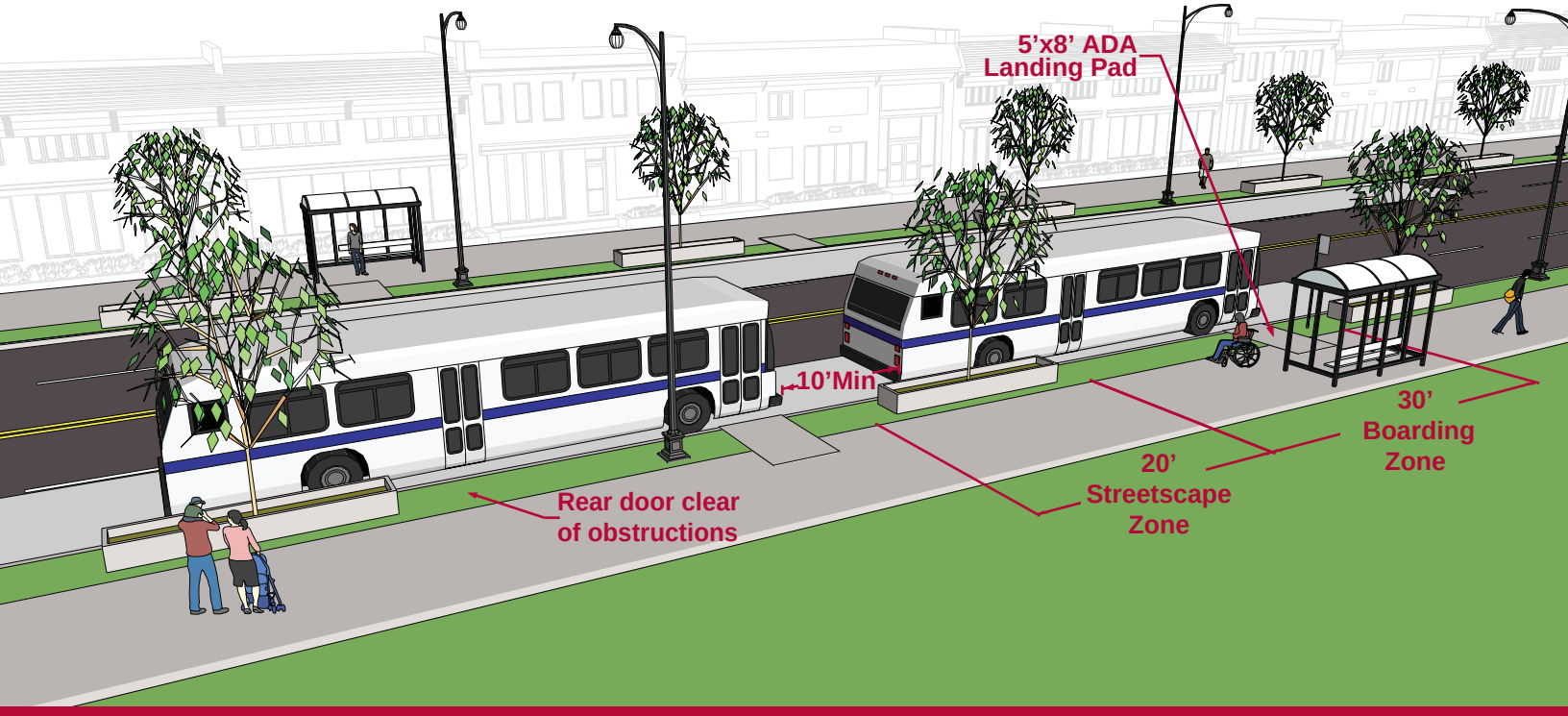
CENTRAL OHIO TRANSIT AUTHORITY

BUS STOP DESIGN GUIDE



COTA
CENTRAL OHIO TRANSIT AUTHORITY
cota.com (614) 228-1776
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1 Introduction

1.1 Purpose

This manual is intended to act as both an internal resource for COTA and as guidance for municipalities and developers to create and review development proposals to ensure that they are consistent with COTA standards and guidelines for providing adequate accessibility and amenities at bus stops.

In general, COTA is solely responsible for the siting and installation of new bus stops, whether those stops are simply a signpost in the ground, a passenger shelter, or a transit hub with enhanced passenger amenities. COTA staff members provide initial recommendations regarding where bus stops will be placed and what amenities, if any, will be installed. COTA then works with the appropriate jurisdiction to obtain permits for the installation of the bus stop and determine the final location. If COTA constructs concrete passenger pads or shelters at a bus stop, it is responsible for ensuring that the bus stop meets all federal, state, and local regulations, including those associated with the Americans with Disabilities Act (ADA).

While it is COTA's role to provide public transit service in the Central Ohio region and to install bus stops, in general it is the role of municipalities and developers to provide infrastructure for pedestrians, motorists, and bicyclists to access that transit service. Thus, when new development or redevelopment occurs at or near an existing COTA bus stop location, it is the developer's (or municipality's) responsibility to ensure that the bus stop can be adequately served by COTA's transit vehicles and easily accessed by transit customers. Adherence to the Americans with Disabilities Act (ADA) guidelines as well as applicable roadway design standards are important to providing access to transit.

COTA encourages developers to take existing and proposed bus stops into account from the beginning of the planning and design processes. Developers and local officials should seek the guidance of COTA staff in making design decisions on development and local infrastructure that affects transit stops. Please note, however, that it is the responsibility of the developer to ensure that all construction and design regulations are met, particularly when they are more stringent than COTA guidelines.

1.2 Goals

These guidelines will help COTA, developers, and municipalities meet the needs of the community by pursuing the following goals:

- Bus stops should be placed in convenient locations that do not compromise the safety of customers, pedestrians, bicyclists, or vehicles.

- Bus stops should be spaced to maximize the efficient operation of transit service while not requiring riders to walk excessive distances (i.e. greater than one half mile) to the nearest bus stop.
- Bus stops should be clearly and consistently identifiable with up-to-date information for riders about services at the bus stop.
- Bus stops should have appropriate amenities based on the usage of that stop and the surrounding land use.
- Where reasonable, bus stops should be accessible. Americans with Disabilities Act (ADA) considerations will be given top priority in the siting and design of new and existing bus stops.
- Bus stops should be well-maintained and free of trash and vandalism.
- Facilities surrounding bus stops such as roadways and pedestrian amenities should be transit-supportive and designed according to sound engineering practices.

COTA should solicit community input for all major bus stop changes and respond promptly to inquiries and complaints from customers and bus stop neighbors.

1.3 About COTA

The Central Ohio Transit Authority (COTA) is the primary provider of transit service in the central Ohio region. COTA's service and taxing area consists of Franklin County and small portions of Delaware, Fairfield, Licking, and Union Counties (See Figure 1-1). The areas served outside of Franklin County are within municipalities that are signatories to the COTA agreement.

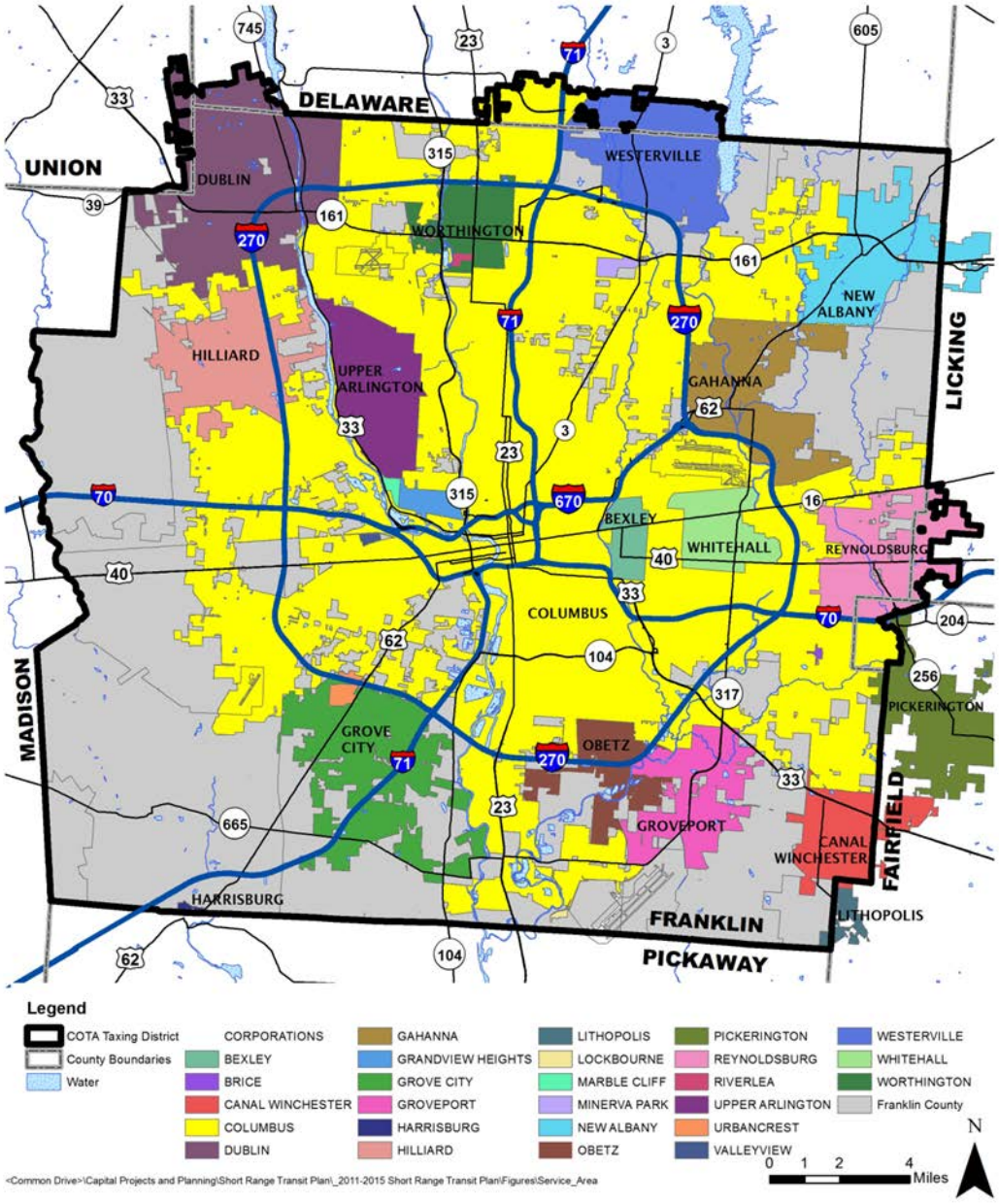


Figure 1-1 COTA Taxing District

COTA's public transit services are provided via two primary operations: fixed-route bus service and demand-responsive service for individuals with disabilities. The backbone of COTA's system is fixed-route bus service. Service is provided on a repetitive, fixed-schedule basis along a defined route, with vehicles stopping for passengers to board and alight at designated bus stops. Since an individual's first impression when choosing to ride COTA is the bus stop, it is important that bus stops are identifiable, safe, accessible, and comfortable.

COTA has over 3,500 locations where customers board and alight transit vehicles. Although there will continue to be bus stops that do not fully achieve the standards outlined in the following pages, these guidelines are a framework for developing and maintaining bus stops that meet the needs of the community. COTA adheres to a policy of non-discrimination to ensure that no person is excluded from participation in, denied the benefits of, or subjected to discrimination on the grounds of race, color, or national origin, with regards to both COTA services and facilities. All standards and recommendations put forth in this document should be applied in accordance with this policy.

2 Procedures for Public and Private Developers

Land use and development affects COTA's current and future transit services, and thus COTA should be consulted with and involved in development projects from an early stage. COTA staff must be involved in the design and planning of the following activities: bus stop installation or upgrades, residential and commercial developments along existing COTA routes, and new developments that will be served by transit. COTA staff work with developers, businesses, and municipalities to integrate transit design features in development plans and to identify viable transit service options if desired. COTA staff provide site and development plan reviews for a variety of projects. Depending on the nature and complexity of the project, COTA staff will typically respond within 10 business days of receipt of the plans regarding any necessary changes or the possibility of follow-up meetings. It is possible that large or complex projects could take 30 days or more.

2.1 Technical Review and Assistance

COTA offers complementary in-house development plan and transit service reviews to municipalities, developers and others in the development community. These reviews are conducted by COTA's Capital Projects and Planning Department and are designed to promote the incorporation of public transportation features in both urban and suburban developments. In some municipalities, plan review by COTA may be required by City code and the standards put forth in this manual must be followed. Whether required or not, COTA staff will analyze site plans and, when appropriate, suggest design options to make developments more easily-served by transit.

In order to review development plans and provide appropriate feedback, COTA requests the following items from the developer:

- Name of the municipality or developer requesting the review
- Your contact person associated with the review
- Project name
- Type of review:
    - Advisory review (not part of a formal plan review process)
    - Development plan approval (part of a formal plan review process)
- Requested date for COTA response
- One paper copy and one electronic copy (in PDF format) of the development plan, including the following at a minimum:
    - Right-of-Way Design and Construction Plans
    - Streetscaping/Landscaping Plan
    - Maintenance-of-Traffic (MOT) Plan
    - Plan Profile
    - Submitted plans should include (at a minimum):
        - Scale

- North arrow
- Date

Detailed plan information allows COTA to identify any needs and requirements related to transit service and bus stop sites. If a site is not designed to accommodate COTA's transit vehicles and design guidelines, COTA reserves the right to withhold transit service until necessary changes are made. This includes ADA accessibility at the bus stop level as well as vehicle access requirements such as turning radii and pavement design.

2.2 Site Plan Review

COTA will review site plans to identify transit needs and opportunities and provide feedback on the designs. Ongoing communication between COTA and the developer may be necessary in order to solidify details of:

- Transit routes and modifications
- Bus stop placement
- Bus stop design, including ADA-compliance and adherence to federal regulations
- Temporary reroutes and bus stops

2.2.1 Transit Routes and Modifications

Whenever a construction project will affect current COTA transit routes, COTA staff must be involved in reviewing plans to ensure that the routes are still serviceable by COTA vehicles. COTA's Planning Department should be contacted as early as possible during the design phase of any construction activity that will affect current bus routes or stops. Roadway design and streetscaping features discussed in Chapter 6 of this document will be particularly pertinent to this review.

When development projects occur outside of COTA's current transit routes but the developer would like for the site to be served by transit, COTA must also be involved in the planning and design process to analyze the possibility of future transit service and provide input into how the site can be designed to best accommodate that service. Information in Chapter 6 of this document will also be relevant for this type of analysis.

2.2.2 Bus Stop Placement

Construction projects that significantly alter the roadway or surrounding land uses may require a re-evaluation of the placement of COTA bus stops. Likewise, the placement of new bus stops due to development or construction will necessitate early involvement from COTA staff to identify appropriate bus stop locations. A number of factors, discussed in Chapter 3 of this document, contribute to the final decisions regarding bus stop placement. During the planning process, COTA will advise on street and site designs that best accommodate bus stops.

2.2.3 Bus Stop Design

The design of bus stops and surrounding areas is very important to COTA for the safety and convenience of passengers as well as for adherence to the requirements of the Americans with Disabilities Act. Bus stop design and amenities are detailed in Chapter 4 of this document, and there are several factors that influence the type of bus stop to be designed and what amenities will be included at each location. Developers should work with COTA at the early stages of site and project planning to identify the opportunities and needs for new or altered bus stops.

Developers should work with COTA and the municipality to design site plans that accommodate bus stop loading pads, passenger shelters, and other amenities where merited. While COTA recognizes that certain communities and neighborhoods may want to install custom bus shelters in some locations, COTA prefers to install its standard shelters for ADA accessibility and maintenance reasons. However, if non-standard shelters are to be installed, the design must first be approved by COTA staff and a formal maintenance agreement will be produced. These issues are also addressed in Chapter 4.

2.2.4 Temporary Reroutes and Bus Stops

When a construction project will affect existing COTA bus routes and bus stops, project managers must contact COTA as early as possible during the planning stages. COTA needs two weeks advance notice of projects that will interfere with service so that proper reroutes and temporary stops can be identified, and so that the public can be given sufficient notice of the service changes. To the extent possible, it is preferred that COTA's bus stops are allowed to remain operational throughout a construction project and that pedestrian access to the bus stops is maintained. On-going communication regarding MOT plans will also be necessary to ensure that COTA's bus operations can continue as smoothly as possible.

3 Bus Stop Placement

On-street bus stops are generally placed in one of three locations: far-side (located immediately after an intersection); near-side (located immediately before an intersection); and mid-block (located between intersections). The specific roadway dimensions associated with placement of bus stops are addressed further in Chapter 6. A general representation of the three main bus stop locations is shown in Figure 3-1.

Each different bus stop location offers advantages and disadvantages to vehicle drivers, bicyclists, and pedestrians. These benefits and drawbacks are listed in Table 3-1. In general, COTA has found that far-side bus stop locations are safer for pedestrians and facilitate faster travel times. However, it is important to note that the final decision on bus stop location is dependent on ease of operation, transfer situations, space availability, traffic volumes, and safety considerations. COTA performs on-site evaluations of each proposed bus stop location to analyze these operating and safety conditions and identify the most appropriate bus stop location for each situation.

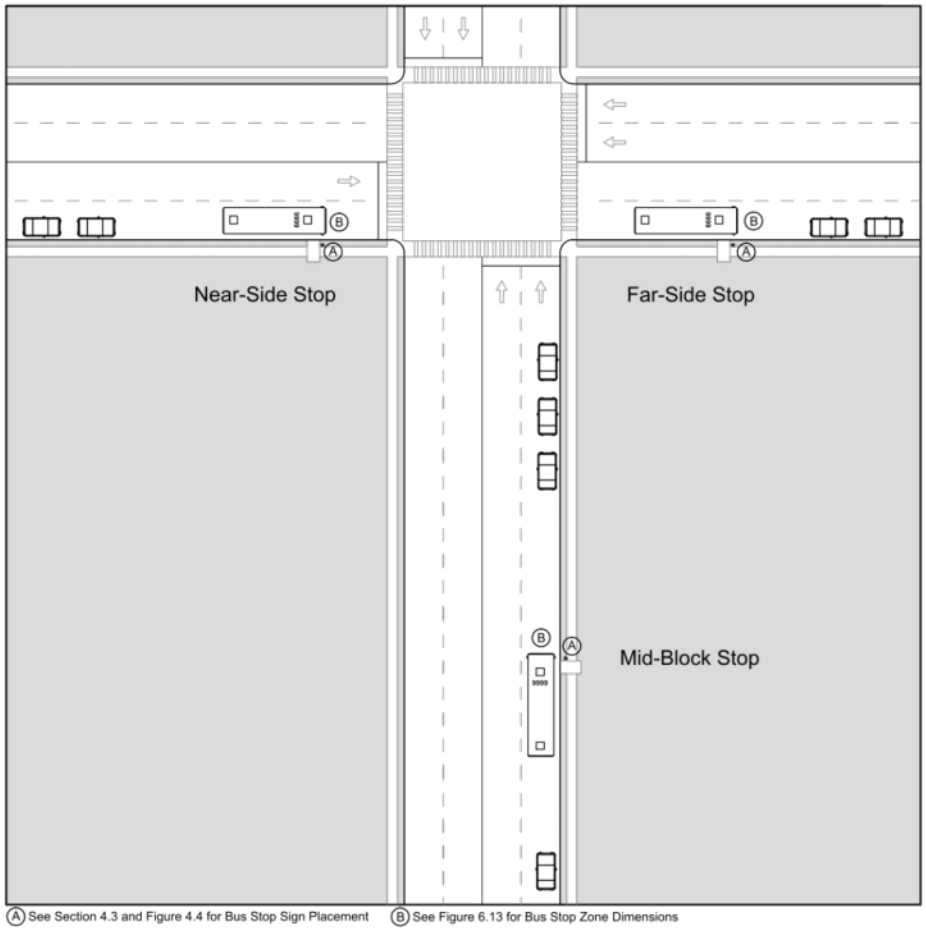


Figure 3-1 COTA Bus Stop Locations

Table 3-1 Characteristics of Bus Stop Locations

Location Related to Intersection	Advantages	Disadvantages	Where Recommended
Far-side	Minimizes conflicts between right-turning vehicles and buses Provides additional right turn capacity by making curb lane available for traffic Minimizes sight distance problems on approaches to intersection Encourages pedestrians to cross behind the bus Creates shorter deceleration distances for buses and minimizes area needed for curbside bus zone Results in bus drivers taking advantage of gaps in traffic flow created at traffic signals	May result in intersections being blocked during peak periods by parked buses May obscure sight distance for crossing vehicles May increase sight distance problems for pedestrians Can cause a bus to stop far-side after stopping for a red light (double stopping) May increase number of rear-end accidents since drivers do not expect buses to stop again after a red light Could result in traffic queued into intersection May interfere with right-turn movement from cross street	There is a high volume of turns Route alignment requires left turn immediately before stop Complex intersections with multi-phase signals or dual turn lanes Traffic is heavier on the near-side Existing pedestrian conditions are better on far-side Traffic conditions and signals may cause delays if near-side Intersections have transit signal priority treatments
Near-side	Minimizes interference when traffic is heavy on the far side of the intersection Allows passengers to access buses closest to the crosswalk Results in the width of the intersection being available for the driver to pull away from the curb Eliminates double stopping Allows passengers to board and alight while the bus is stopped at a red light Provides driver with opportunity to look for oncoming traffic	Increases conflicts with right-turning vehicles May result in stopped buses obscuring curbside traffic control devices and crossing pedestrians May cause sight distance to be obscured for cross vehicles stopped to the right of the bus May block the through lane during peak period with queuing buses Increases sight distance problems for crossing pedestrians	Traffic is heavier on the far-side Existing pedestrian conditions are better than on the far-side Pedestrian movements are safer on near-side Bus route continues straight through the intersection
Mid-block	Minimizes sight distance problems for vehicles and pedestrians May result in passenger waiting areas experiencing less pedestrian congestion May be closer to passenger origins or destinations on long blocks	Requires additional distance for no-parking restrictions Encourages unsafe pedestrian crossing Increases walking distance for patrons crossing intersections, or requires special features for patrons crossing at mid-block locations	When the route alignment requires a right turn and curb radius is short Problematic traffic conditions at the intersection Passenger traffic generator is located mid-block Compatible with corridor or district plan

3.1 Bus Stop Installation Considerations

In addition to considering where a bus stop should be placed relative to an intersection, the decision to install a bus stop at a certain location should take into account the following factors:

- Adjacent land use and activities, including major trip generators and origins/destinations of special populations
- Bus route alignment (for example, turning movements at an intersection)
- Intersecting transit routes and transfer possibilities
- Pedestrian access – accessibility should be considered in the placement of all new bus stops; though the construction of sidewalks and other pedestrian infrastructure is often beyond the control of COTA, bus stops should be placed in accessible areas to the extent possible given existing conditions
- Existing right-of way - wherever possible, bus stops should be located where there is adequate right-of-way space for the construction of passenger amenities
- Traffic conditions (volume and speed) and traffic control devices

Specific bus stop location criteria, including parking setbacks, are discussed in Chapter 6.

3.2 Safety

For the safety of pedestrians as well as drivers, bus stops should not be placed in the following locations:

- Over the crest of a hill, where oncoming traffic will be unable to see a stopped bus
- Around a blind curve, where oncoming traffic will be unable to see a stopped bus
- On the side of a roadway with limited space for pedestrian movement (i.e. constrained by a ditch, guardrail, or retaining wall)
- On limited-access roads

3.3 Other Placement Considerations

- Bus stops should be easy to see for pedestrians, bicyclists, drivers, and bus operators
- Buses should not block residential or commercial driveways when stopped; if blocking a driveway is necessary for operational reasons, it is better to fully block a driveway rather than partially so that vehicles do not attempt unsafe maneuvers in front of or behind the stopped bus
- Bus stops should preferably be placed close to existing pedestrian crossings, good pedestrian infrastructure, and adequate lighting
- Bus stops placed extremely close together should be avoided in most cases (addressed further in Chapter 5)
- In high-transfer locations, bus stops should be located so as to minimize the intersection crossings required of transferring patrons
- In areas with on-street parking, parking restrictions will need to be put in place to ensure bus access to the curb (see Chapter 6)

4 Bus Stop Elements and Amenities

COTA strives to provide bus waiting areas that are easy to identify and access, with convenient passenger amenities. Like most transit agencies, COTA has limited resources to achieve this goal, so it is necessary to prioritize when and where these improvements are made.

4.1 Accessibility and ADA Compliance

Adherence to the Americans with Disabilities Act (ADA) regulations and general accessibility is one of COTA's primary considerations when siting new bus stops or making alterations to existing bus stop locations. The construction and alteration of transportation facilities covered by the ADA is currently guided by the 2006 Department of Transportation's ADA Standards for Transportation Facilities. This document applies to all bus stops and dedicated bus facilities, such as transit centers and Park and Rides. Section 810 of the Department of Transportation (DOT) ADA Standards addresses transportation facilities specifically and lays out the following general information regarding the construction or alteration of bus stops:

- Bus stop boarding and alighting areas shall have a firm, stable surface (COTA prefers concrete, but any material conforming to section 4.5 of the Americans with Disabilities Act Accessibility Guidelines and section 302 of the DOT ADA Standards is acceptable)
- Boarding and alighting areas shall provide a clear space of at least 96 inches perpendicular to the roadway and 60 inches parallel to the roadway
- Parallel to the roadway, the slope of the bus stop boarding and alighting area shall be the same as the roadway, to the maximum extent practicable. Perpendicular to the roadway, the slope of the bus stop boarding and alighting area shall not be steeper than 2.08% (*Design facility to slope of 1.56%)
- Boarding and alighting areas shall be connected to streets, sidewalks, or pedestrian paths by an accessible route complying with section 402 of the DOT ADA Standards
- Bus shelters shall provide a clear floor space complying with section 305 entirely within the shelter (for COTA's standard shelter design, the applicable clear floor space must be 30" by 48")
- Bus shelters shall be connected to the boarding and alighting area by an accessible route complying with section 402 of the DOT ADA Standards

ADA regulations require that bus stops are made fully-accessible whenever a pedestrian route is constructed or repaired at a planned or existing COTA bus stop.

For example, if a developer or other entity is building or reconstructing sidewalks where bus stops are present, each bus stop in the project area must be upgraded to an accessible stop. This means that, at a minimum, a 60-inch by 96-inch concrete passenger pad should be constructed at any bus stop where a new sidewalk (or other pedestrian path) is installed. Where construction of a passenger pad is impracticable (e.g. inadequate right-of-way), this

requirement may be waived in accordance with applicable ADA regulations. At bus stops with high ridership, COTA may request that a concrete pad large enough to accommodate a standard passenger shelter be constructed (see details in section 4.7).

Because passenger pads and shelters must be connected to an accessible pedestrian route, COTA will not construct passenger pads or shelters in locations without existing sidewalks. In these instances, COTA bus stops will be indicated by a sign only, and a concrete passenger pad will be constructed only when a sidewalk or other pedestrian route is installed. Where COTA bus stops are indicated by a post and sign only, the construction of a passenger pad is not required.[1]

COTA will adhere to the following policies when constructing or modifying bus stops:

New Bus Stop Construction:

- When COTA constructs a passenger loading pad and/or passenger shelter at a new bus stop location, all elements of the bus stop itself (passenger loading pad, passenger shelter, and pedestrian route connecting the shelter and pad) will be constructed to ADA specifications.
- If there is an existing sidewalk at the bus stop location, COTA will ensure that the passenger shelter and passenger loading pad are connected to that sidewalk by an accessible route.
- If there is not an existing sidewalk at the bus stop location, COTA will work with appropriate entities to provide a pedestrian route from the bus stop that connects to existing streets, sidewalks, or other pedestrian paths.

Alterations to Existing Bus Stops:

- When COTA makes alterations to an existing bus stop location, it will ensure that all elements of the bus stop itself (passenger loading pad, passenger shelter, and pedestrian route connecting the shelter and pad) are made to meet ADA specifications to the extent practicable.
- If there is an existing sidewalk at the bus stop location, COTA will ensure that the passenger shelter and passenger loading pad are connected to that sidewalk by an accessible route.
- If there is not an existing sidewalk at the bus stop location, an accessible path of travel should be provided to the extent practicable. Alterations to the path of travel will be deemed “disproportionate” if the cost of such alterations exceeds 20% of the cost of alterations to the bus stop itself. (CFR 49, 37.43.e.1)

[1] Appendix D to Part 37 – Construction and Interpretation of Provisions of 49 CFR Part 37

Note that municipal standards may differ from the ADA Standards in some instances, and the developer/installer must follow the most stringent requirements. For example, while the 2006 DOT ADA Standards specify that accessible routes can be a minimum of 36 inches, the City of Columbus requires a minimum of 48 inches for an accessible route. Furthermore, the proposed Public Rights-of-Way Accessibility Guidelines developed by the United States Access Board are expected to become law within the next year. Once these guidelines are adopted, these are the standards that must be followed for pedestrian access routes and transit stops within the public right-of-way.

All ADA Standards for bus stop boarding and alighting areas, passenger shelters, and accessible routes are represented in the bus stop prototype drawings provided in sections 4.6 and 4.7 of this chapter. Note that ADA standards and guidelines are frequently updated and revised. To ensure usage of the most recent standards, check the Access Board's website for news and updates (http://www.access-board.gov)

For sidewalk widths and other pedestrian features of bus stop areas, developers must follow the most stringent standards applicable to each specific project and jurisdiction. Additionally, when modifying bus stops or surrounding areas, developers must obtain the required permits (right-of-way, building, signage, etc.) from the appropriate jurisdiction.

4.2 Bus Stop Types

COTA's transit system includes approximately 3,500 bus stops, many of which were installed over 20 years ago. Because the amenities provided at bus stops depend highly on existing conditions and budgetary constraints, COTA has created a hierarchy of bus stop types that will guide the provision of passenger amenities. Note that there are no strict criteria that determine whether a particular bus stop will be basic, accessible, or a transit hub. Instead, amenities at bus stops are determined on a case-by-case basis and affected by a variety of factors, including but not limited to ridership, existing conditions, transfer opportunities, and special populations. Developers undertaking construction at existing or proposed bus stops must contact COTA to determine how the bus stops should be categorized.

Basic Stops: These are boarding/alighting areas that are demarcated by the placement of a COTA route sign, with no additional improvements. These types of bus stops are placed in areas with no existing sidewalks and in areas where there may be existing sidewalks but no other construction was being performed at the time of installation.

Figure 4-1 Example of Basic Bus Stop

Accessible Stops: These are boarding/alighting areas that have, at a minimum, an ADA landing pad connected to a sidewalk network, and a COTA route sign. Additional amenities such as shelters are recommended for accessible stops that have adequate ridership. Section 4.7 contains more information about the ridership requirements for shelters. COTA's policy for where stops should be made accessible is explained in section 4.1.

Figure 4-2 Example of Accessible Stop

Transit Hubs: These are boarding/alighting areas that are located at major destinations, high-transfer locations, or COTA-owned Park and Rides or transit centers. At a minimum, these bus stops should be ADA-compliant, but they should also have additional amenities to accommodate the number of passengers including at least one shelter, but more if necessary.

Figure 4-3 Example of Transit Hub

Table 4-1 Hierarchy of COTA Bus Stop Types

Amenity	Basic Stop	Accessible Stop	Transit Hub
COTA Sign	Yes	Yes	Yes
Regulatory Sign	Yes	Yes	Yes
ADA Landing Pad	No	Yes	Yes
Information Case	No	No	Yes
Shelter	No	Site Specific	Yes
Lighting	No	No	Yes
Trash Receptacle	Site Specific	Site Specific	Yes
Bicycle Rack	No	No	Yes

4.3 COTA Sign

COTA bus stops are designated by the placement of a COTA bus stop sign. The COTA bus stop sign should be securely mounted on its own post at an angle perpendicular to the street. The signs should be placed at least 2 feet away from the face of curb in order to be clear of side mirrors of a bus (note also that *all signs* within the bus stop zone, including signs installed by other parties, should be set back at least 2 feet from the face of curb). Final bus stop sign placement should also be in compliance with the applicable operational offset distance required by FHWA, AASHTO, and ODOT.

For best visibility, bus stop signs should usually be placed 2 feet from the face of curb and no further than 4 feet away from the face of curb so that they are still clearly visible to patrons and bus drivers. However, the exact distance of the sign from the curb will vary depending on site conditions, and only in limited circumstances shall the sign be placed beyond the 4-foot desired limit and in a location where it is visible to the bus operator. Per section 403.5.1 of the DOT ADA Standards, the clear width of the pedestrian accessible route is permitted to be reduced to 32 inches for a length of 24 inches by an obstacle such as a bus stop sign. So for example, if a sign is to be installed at a location with a 4-foot sidewalk adjacent to the roadway, installing the sign post 2 feet from the face of curb would place the sign in the middle of the sidewalk and obstruct the pedestrian pathway. In this case, the sign should be installed on the far side of the sidewalk (furthest from the roadway) in order to preserve the full pedestrian path. The sign flag should be mounted on the pole perpendicular to the roadway and allow for 7 feet of clearance below the bottom of the sign. Sign placement details are shown in Figure 4-4.

Sign placement within the no-parking zone will vary based on the type of stop—near-side, far-side, or mid-block—and is measured from either the curb radius or the end of the no-parking zone, as shown in Figure 4-5. The distances shown in Figure 4-5 are for guidance only, as the final placement of bus stop signs will depend on specific site conditions and the location of other street elements such as trees and traffic signs. In general, however, bus stop signs should be placed so that, when the front of the stopped bus is in line with the sign, neither the front nor the back of the bus is obstructing the intersection or pedestrian crossings. If the measurements detailed below are followed, the bus will never block pedestrian crossings when stopped at the appropriate location. Additionally, bus stop signs should almost always be placed downstream (far-side) of the passenger shelter, unless sight lines dictate otherwise.

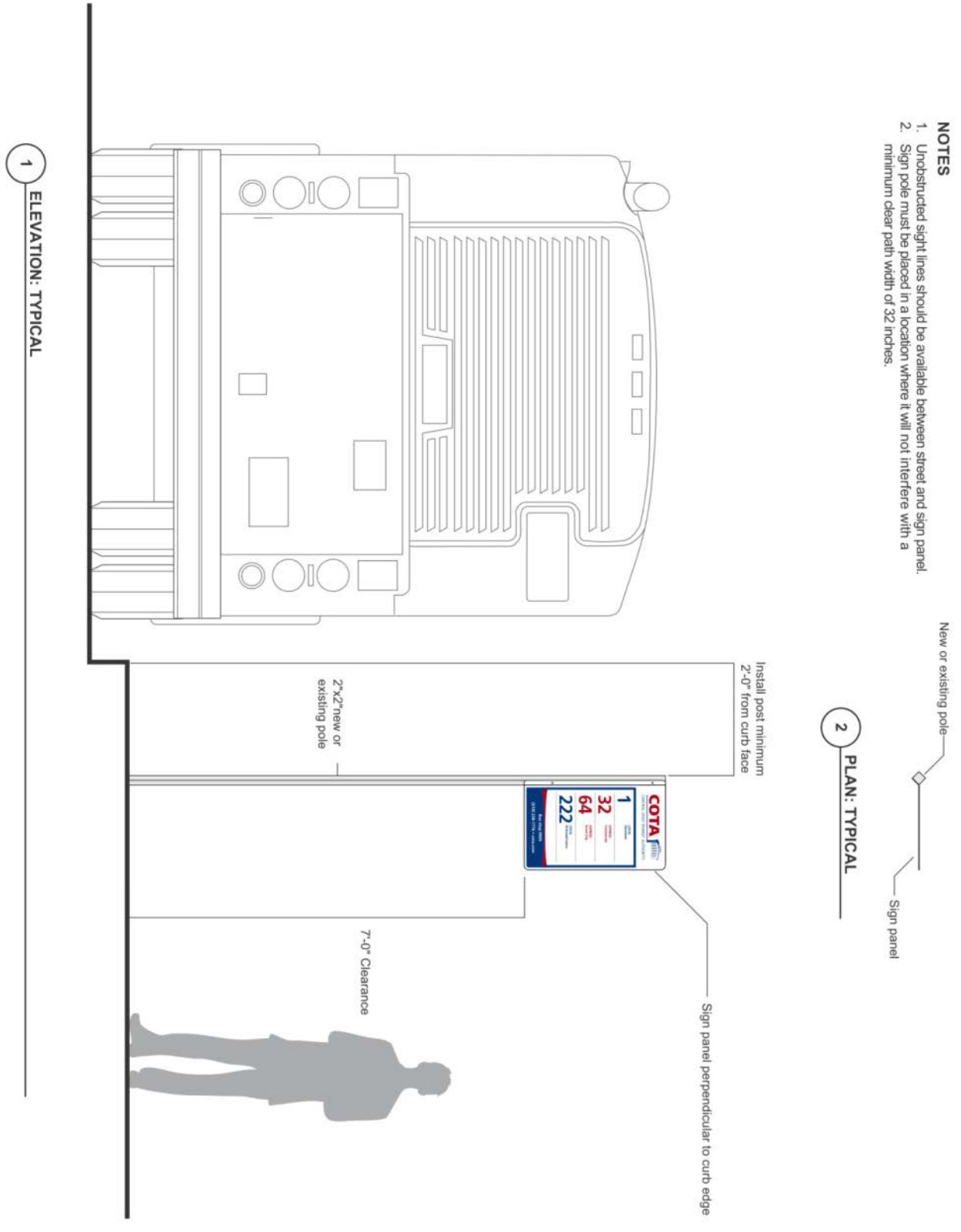
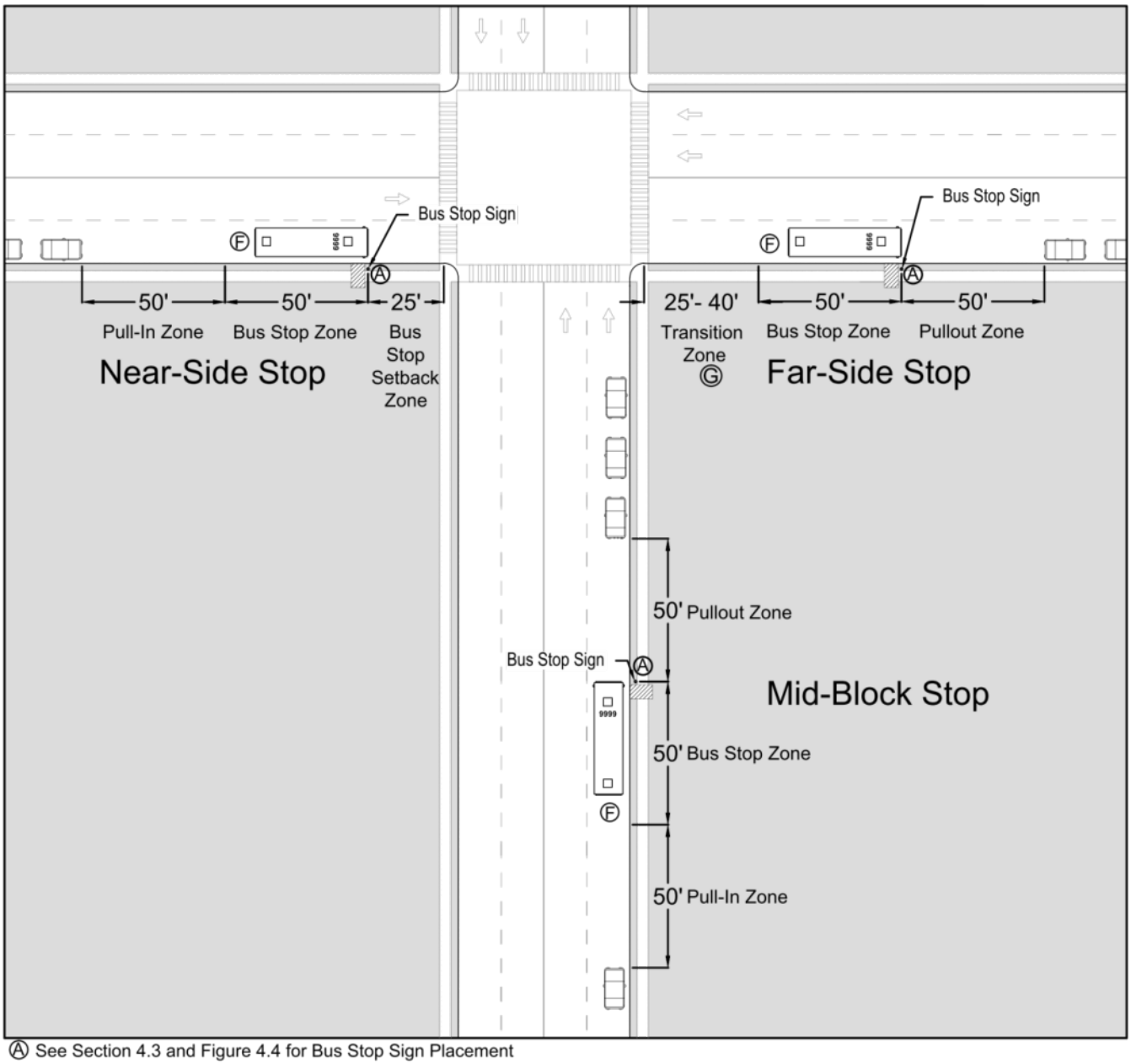


Figure 4-4 Bus Stop Sign Elevation and Lateral Placement



Ⓐ See Section 4.3 and Figure 4.4 for Bus Stop Sign Placement
Ⓕ Add 50' to Bus Stop Zone for Each Additional Pass-Through Bus or 70' for Each Additional Pass-Through Articulated Bus
Ⓖ 25' Minimum for Straight-through Movement
40' Minimum After Right Turn

Figure 4-5 Bus Stop Sign Placement

COTA is currently in the process of installing newly-designed bus stop signs throughout its system. These new signs, shown in Figure 4-6, display text indicating which routes serve the stop as well as that stop's 4-digit stop identification number. These 4-digit numbers can currently be used to access schedule information, and beginning in the second quarter of 2014, these numbers will also be used to access real-time bus arrival information at each stop. At stops that are served by more than six lines, a modified sign design is used. These signs are primarily used in Downtown Columbus. Finally, a third, round sign design is used to denote stops that are served by the Downtown Circulator. This sign is installed on the same post as COTA's standard sign where the bus stop is served by the Downtown Circulator as well as other routes. Where a stop is only served by the Downtown Circulator, this sign is installed on its own post.

All current and future bus route identification signs must comply with the most current ADA standards available. Additional details regarding sign colors and letter sizes for each of COTA's signs are available upon request.

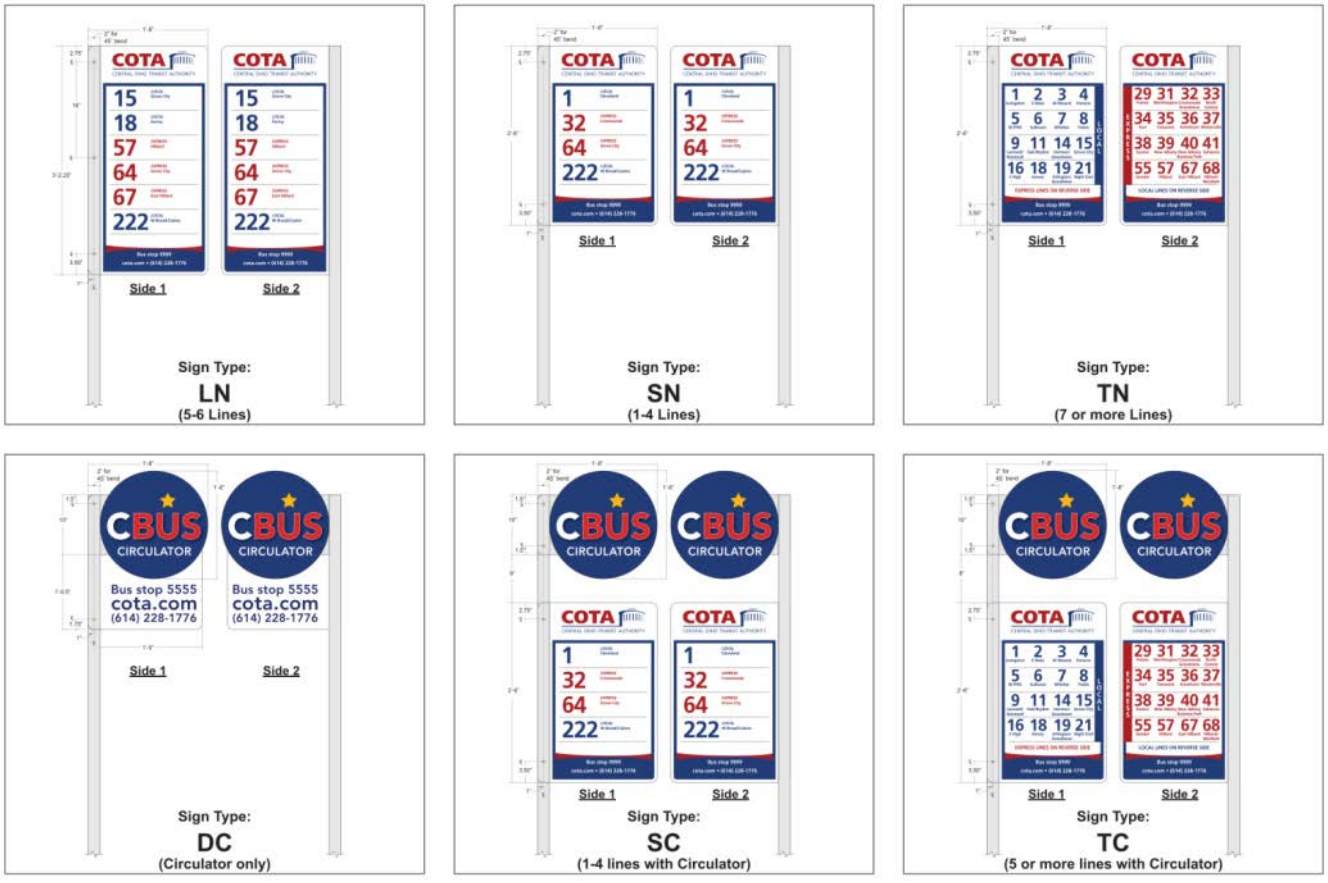


Figure 4-6 COTA Bus Stop Sign Design

4.4 Regulatory Sign

COTA requests that municipalities place no-parking signs demarcating each end of the bus stop zone. Municipalities should also enforce no-parking zones, as illegally parked vehicles interfere with bus operations. More information about the amount of space needed for on-street bus stop zones can be found in Chapter 6: On-Street Physical Characteristics.

4.5 Information Cases

COTA places several different kinds of information cases at select stops:

- Wayfinders, which are large, standalone cases containing general information about how to use COTA, are located at high ridership stops in the OSU campus area.
- Informational posters, including scheduled arrival times, are posted in bus shelters on High Street within downtown Columbus.
- Information cases containing scheduled bus arrival times are typically 8.5" wide by 22" tall and mounted on COTA sign poles. These are typically placed at park & rides and at high ridership stops in the OSU campus area.

4.6 ADA Landing Pad

Level and paved waiting areas with adequate space provide greater access to transit service for wheelchair users, the elderly, and other encumbered riders such as parents with strollers. According to the USDOT's 2006 ADA Standards for Transportation Facilities, where landing pads are provided, they must be:

- Firm and stable. COTA requires the surface to be concrete or other material accepted by the municipality and compliant with section 302 of the DOT ADA Standards.
- Clear of obstructions, at least 96 inches (8 feet) perpendicular from the curb/roadway and at least 60 inches (5 feet) parallel to the roadway. A landing area of this size or larger is necessary for deployment of the vehicle's ramp and lift and for a customer using a wheelchair to maneuver on and off the lift.
- Connected to streets, sidewalks, or pedestrian paths by an accessible route. Any local requirements above ADA for accessible routes must also be met. For example, the City of Columbus requires a 48-inch pedestrian accessible route, while the current DOT ADA standards specify a 36-inch minimum width for accessible routes.[2]
- Sloped (parallel to the roadway, i.e. running slope) the same as the roadway, to the maximum extent practicable. Perpendicular to the roadway (cross slope), the slope of the landing area shall not be steeper than 2.08%. (*Slope should be designed to 1.56%)

[2] City of Columbus Wheelchair Ramp Requirements, effective March 5, 2011

Figure 4-7, from the USDOT's 2006 ADA Standards, illustrates the dimensions and placement of an ADA landing pad.

At bus stops where a shelter is provided, the bus stop pad can extend into the clear floor space of the shelter. It is crucial that the landing pad is not blocked by any obstacles such as newspaper stands, trash receptacles, bike racks, or flower pots.

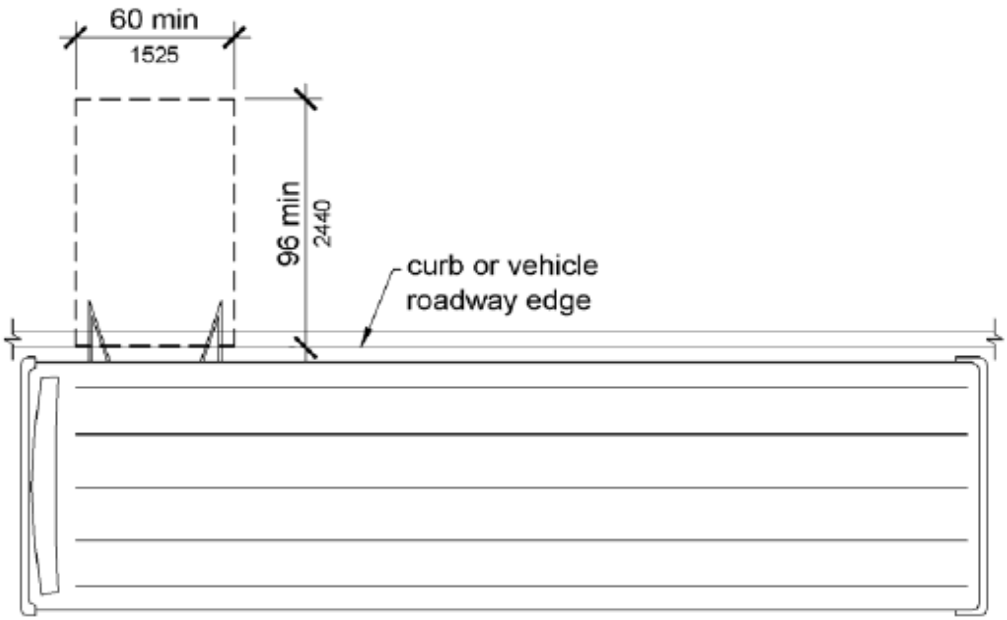


Figure 4-7 ADA Landing Pad

Figure 4-8 shows a prototype of an ADA landing pad in a location where the sidewalk is adjacent to the curb, and Figure 4-9 shows an example of an ADA landing pad where the sidewalk is setback from the curb. The landing pad/waiting area should be connected to an accessible sidewalk. Detectable warning strips should be installed where the passenger pad is not separated from the roadway by a curb.

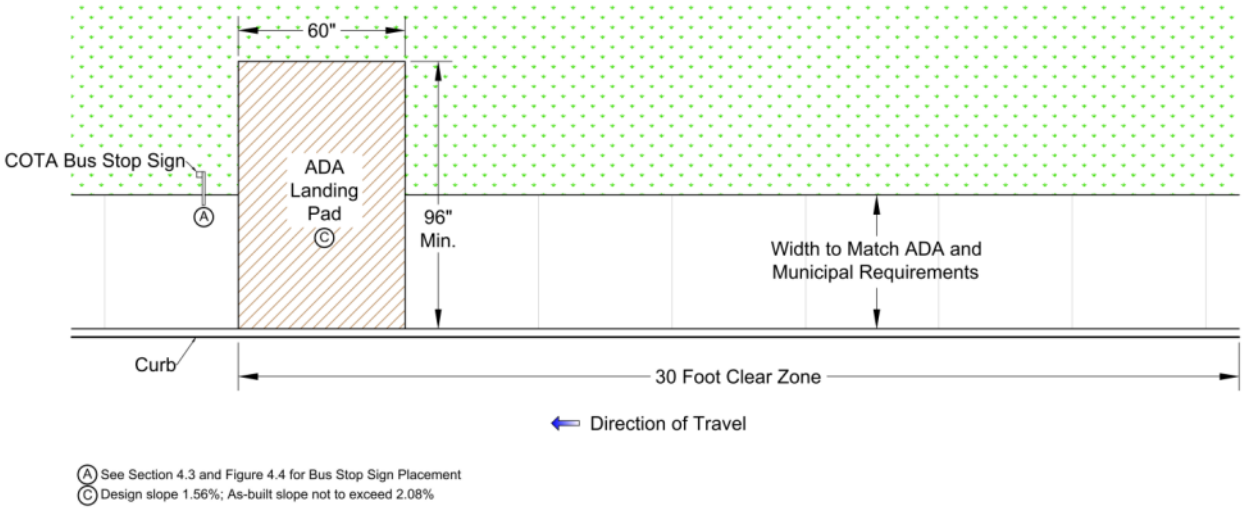
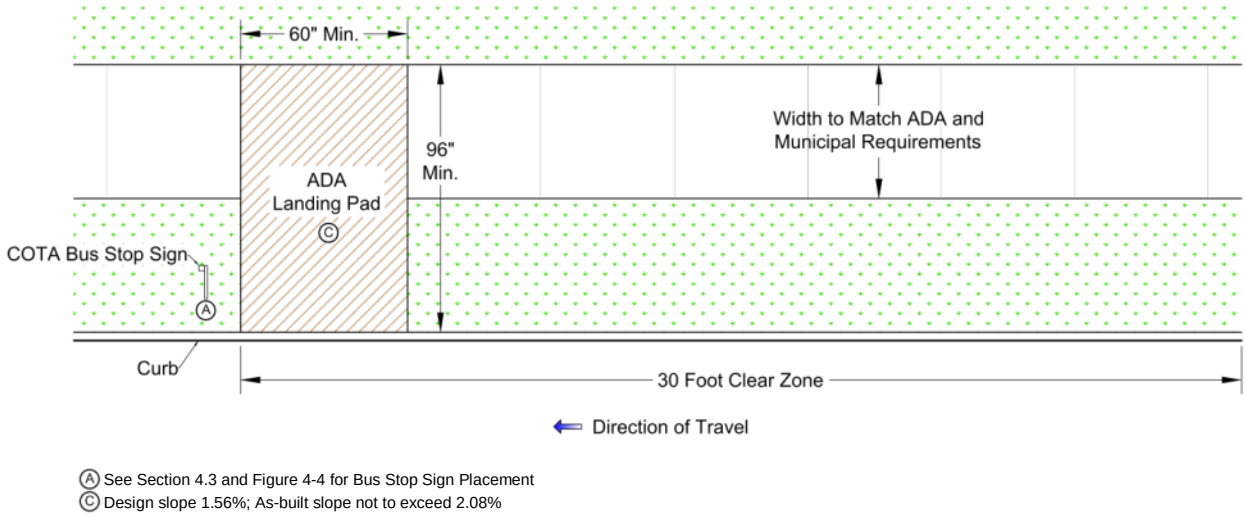


Figure 4-8 ADA Landing Pad with Sidewalk Adjacent to Curb



Ⓐ See Section 4.3 and Figure 4-4 for Bus Stop Sign Placement
Ⓒ Design slope 1.56%; As-built slope not to exceed 2.08%

Figure 4-9 ADA Landing Pad with Sidewalk Setback from Curb

The current Federal Transit Administration's (FTA) interpretation of the ADA is that the construction of a landing pad is not required unless other improvements are constructed (i.e., a stop can be designated by a sign without constructing a new landing pad, see section 4.1).[3] However, when municipalities or other entities undertake construction or renovation of an accessible pathway in close proximity to an existing or proposed bus stop, COTA requires that the project include making those stops fully ADA accessible, including an ADA landing pad and accessible route to the stop. COTA will place new stops in accessible locations to the maximum extent practicable but will not install a pad or shelter in locations without existing pedestrian facilities.

4.7 Shelters

COTA owns and maintains approximately 350 passenger shelters, primarily located at major boarding or transfer locations, park & rides, shopping centers, and medical facilities. While COTA strives to provide comfortable waiting areas for all passengers, shelter installation must be prioritized due to limited resources.

4.7.1 Site Selection Process

COTA uses ridership numbers as the primary criterion for determining which bus stops warrant shelters. Locations with 35 passenger boardings per day or more will be considered for shelters. Yet, there are additional criteria that are taken into account that support the placement of a shelter:

[3] 49 CFR Subtitle A (10-1-11 Edition) Pt. 37, App. D, http://www.gpo.gov/fdsys/pkg/CFR-2011-title49-vol1/pdf/CFR-2011-title49-vol1-part37.pdf

- Proximity to medical facilities
- Proximity to senior housing
- Frequent wheelchair lift usage
- Major transfer point
- Serves a park & ride
- Serves a major activity center
- Shelters funded and maintained by others

If a bus stop meets COTA's shelter criteria, it may be considered for passenger shelter placement. Meeting these criteria, however, does not guarantee shelter installations. Existing site conditions such as the following may make shelter placement unfeasible:

- Adequate shelter of some type is readily available
- Shelter location is not approved by the local authorities
- Shelter location generates severe local citizen/business opposition
- Inadequate Right-of-Way
- Lack of existing pedestrian amenities

4.7.2 Placement

Shelters should generally be placed so that they are facing the travel lane to ensure that the bus operator can easily see the waiting passengers and that there is minimal walking distance from the waiting area to the boarding area. However, some specific sites may call for a rear-facing shelter; for example, where ADA access can only be achieved with a rear-facing shelter due to narrow right-of-way. Shelters should not be placed within 15 feet of a fire hydrant or a handicap-accessible parking space. If a shelter is installed adjacent to a building or structure, a minimum of a 12-inch gap should be preserved to allow for trash removal and cleaning of the shelter. Finally, the location of utility access points should be taken into account when installing shelters.

No matter how the shelter is placed, all shelters must meet both local jurisdictional accessibility requirements and DOT's 2006 ADA Standards:

- **Maintain Clear Floor or Ground Space within Shelter:** Provide a minimum clear floor or ground space of 30 x 48 inches, entirely within the shelter to accommodate wheelchair users. Figure 4-10 illustrates these dimensions. COTA's standard shelter is designed for a forward approach to the Clear Floor or Ground Space. However, other shelter designs may accommodate parallel approaches.
- **Include an ADA Landing Pad:** When constructing a bus stop with a shelter, a 60 x 96 inch landing pad that is clear of obstructions must also be built. See the section above for more details about the ADA landing pad.
- **Connect Shelter to ADA Landing Pad and Sidewalk Network:** Connect the shelter to the ADA landing pad and the sidewalk network via an accessible route.

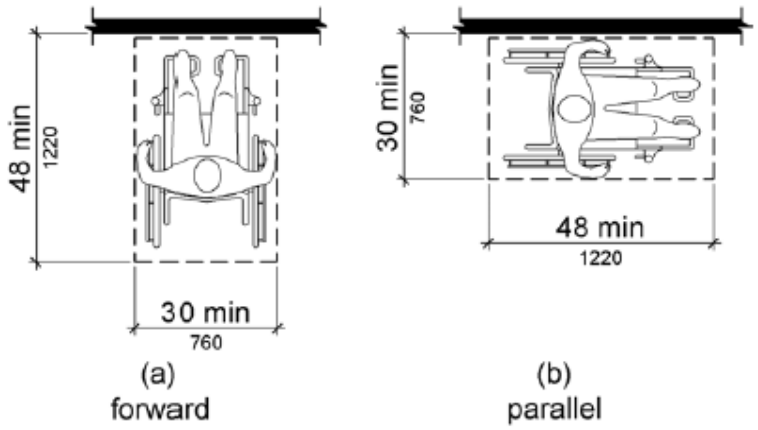


Figure 4-10 Dimensions of Clear Floor or Ground Space

While the DOT's 2006 ADA Standards call for a minimum width of 36 inches on all walking surfaces, the City of Columbus requires a 48 inch minimum width for all pedestrian accessible routes. Developers must follow the most stringent standards applicable to each specific project and jurisdiction. Figure 4-11 below shows a general example of an accessible route between a shelter and boarding area. The running slope of walking surfaces shall not be steeper than 5%. The cross slope of walking surfaces shall not be steeper than 2.08%. The accessible route cannot be obstructed by any object such as sign poles, trash receptacles, or landscaping, with the exception of objects that reduce the clear width of the pedestrian accessible route to 32 inches for a length of 24 inches, per section 403.5.1 of the DOT ADA Standards. Note that the accessible route must meet other ADA and jurisdictional requirements that may not be listed here.

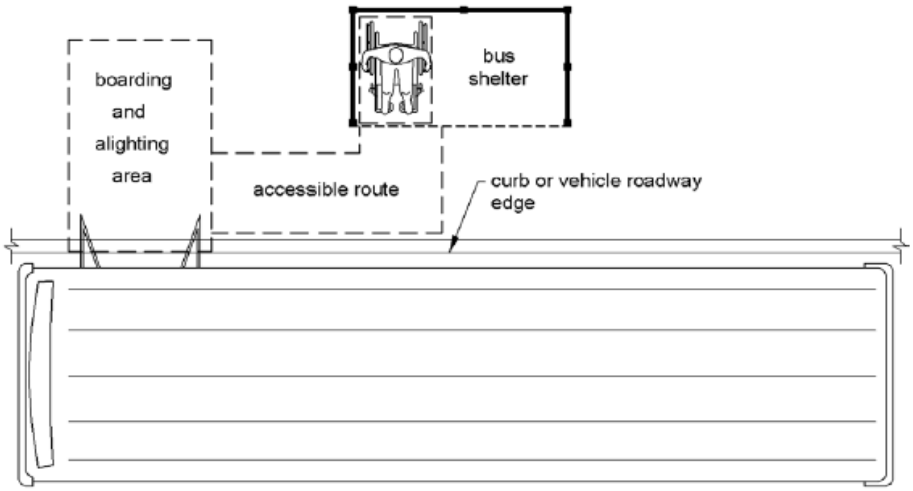


Figure 4-11 Accessible Route from Shelter to Boarding Area

Bus stops with shelters can be laid out in several ways to meet these accessibility requirements. The exact layout will be determined by the constraints of the site. Figures 4-12 through 4-16 are prototypes of acceptable layouts of bus stops with shelters.

The dimensions in these layouts are based on COTA's large standard shelter design, which is detailed later in this section. COTA requires that passenger shelters are set back 5 feet from the face of curb in order to facilitate easy entrance and exit as well as the wheelchair turning radius, unless the shelter is installed in a rear-facing design. Note that the rear-facing shelter design, shown in Figure 4-16, is not COTA's preferred bus stop layout. However, in areas with limited right-of-way, this type of bus shelter layout may be the only way to provide a bus shelter while still meeting ADA accessibility requirements.

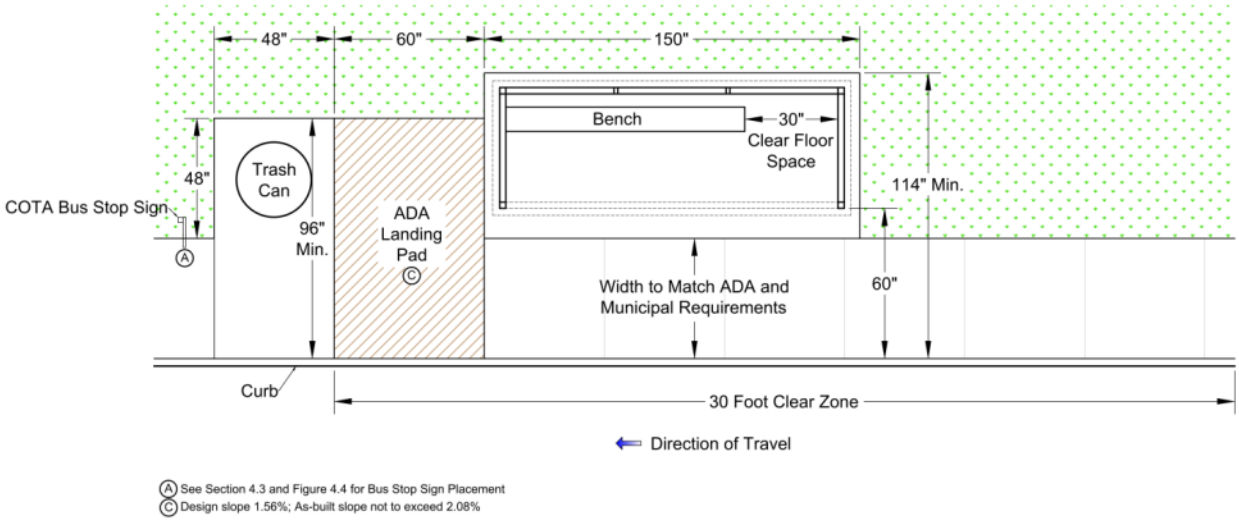


Figure 4-12 Bus Shelter with Adjacent Sidewalk and ADA Landing Pad Next to Shelter

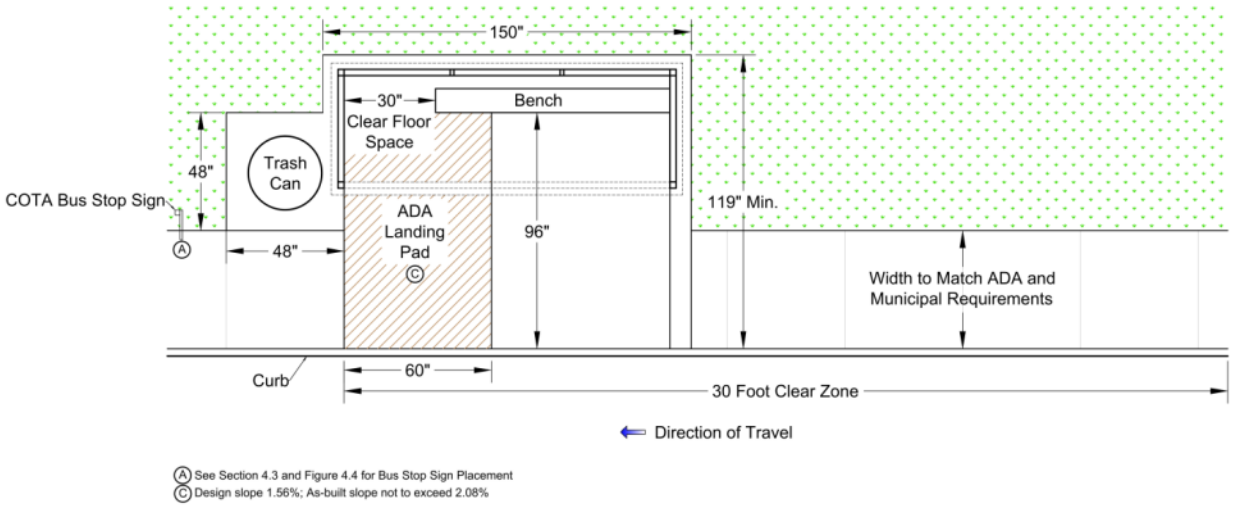


Figure 4-13 Bus Shelter with Adjacent Sidewalk and ADA landing Pad in front of Shelter

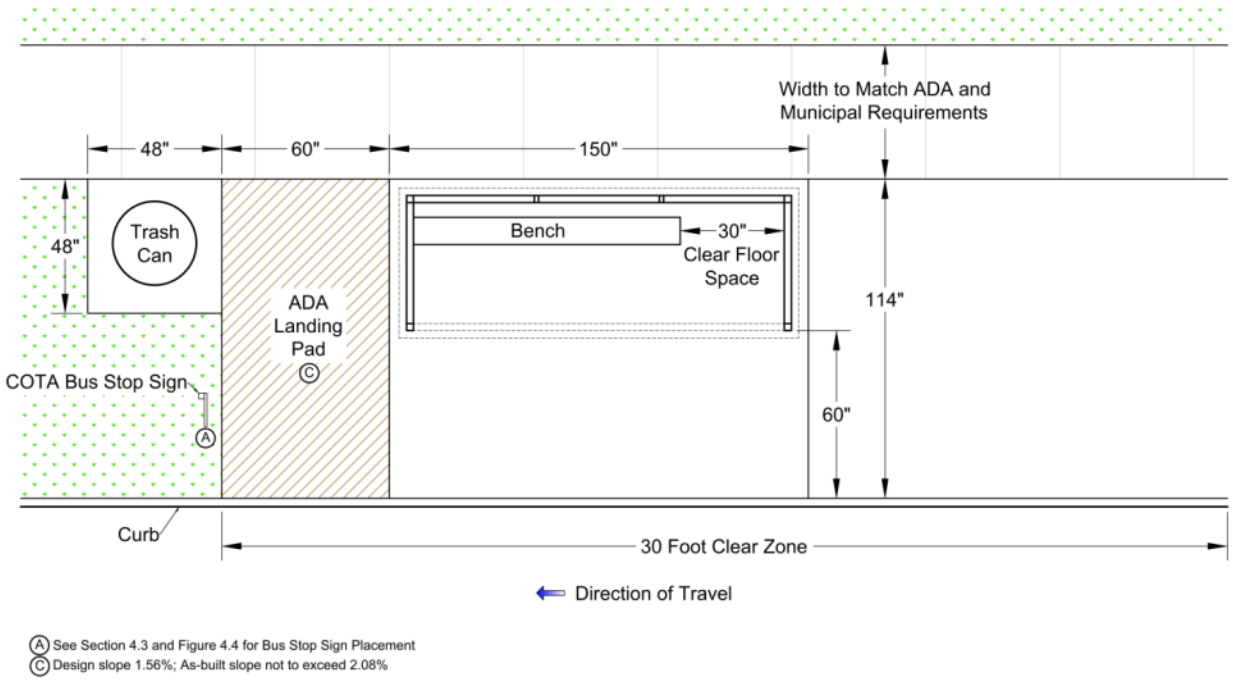


Figure 4-14 Bus Shelter with Setback Sidewalk and ADA Landing Pad next to Shelter

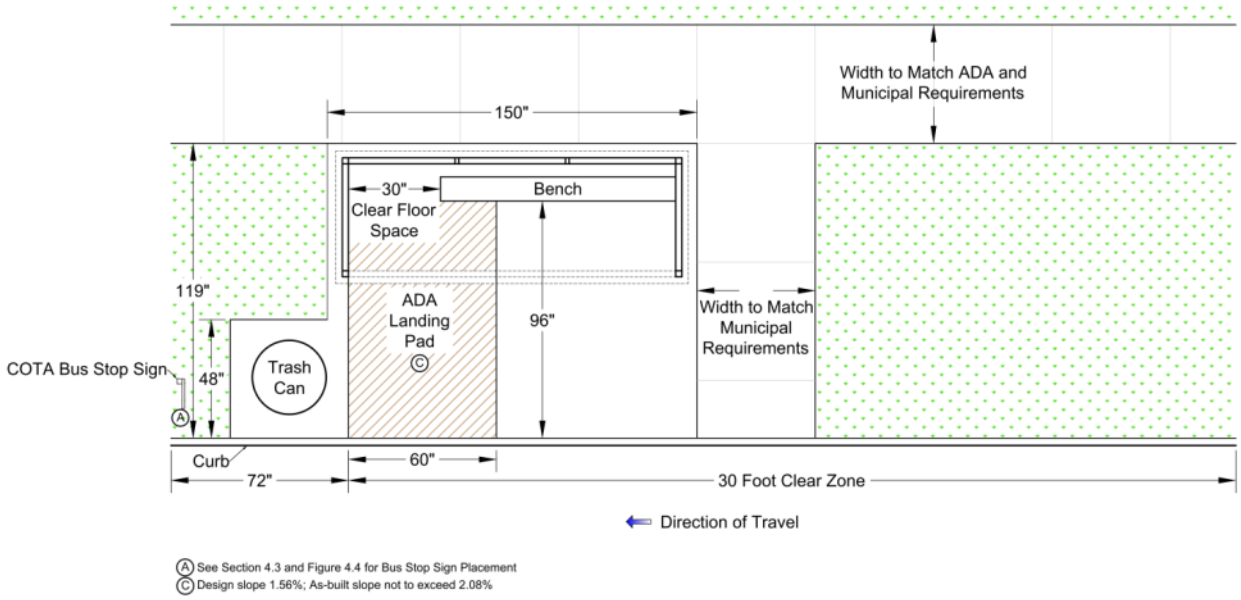


Figure 4-15 Bus Shelter with Setback Sidewalk and ADA Landing Pad in front of Shelter

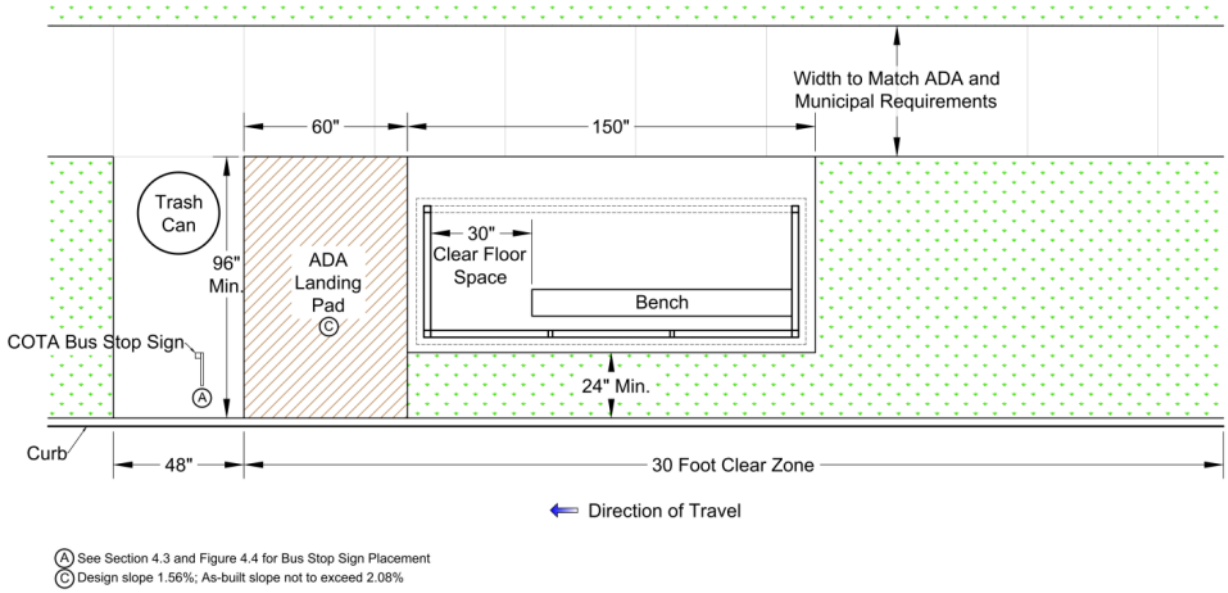


Figure 4-16 Rear-Facing Bus Shelter Design

4.7.3 Standard Shelter Design (Full- and Half-Size)

COTA uses a standard shelter design in order to minimize maintenance costs and keep bus stops easily-identifiable to customers. Since different shelter designs use various sizes and types of glass panes, it is inefficient to keep numerous types of replacement panes in stock. Having a standard shelter design throughout the service area helps keep costs down and allows COTA to repair shelters more efficiently. As of 2012, COTA uses full (4x12) and half (4x10) size shelters. Dimensions of these shelters are shown in Figures 4-17 and 4-18. The larger shelter is used in most locations for its larger capacity; however, the smaller shelter size can be used in locations where necessary due to site limitations. Figure 4-19 details the placement and installation of the standard bench and rub-rail inside the shelter.

Any special shelter designs that may be provided by private developers or other groups should conform to these measurements to the extent possible. The decision to place non-standard shelters will be made on a case-by-case basis and will require a maintenance agreement with COTA, as the maintenance of custom shelters is usually the responsibility of the developer, municipality, or other appropriate party. In particular, the glass panel sizes of any non-standard shelters should be consistent with COTA's standard shelters for cost-effective maintenance. The glass panel specifications for COTA shelters are as follows:

- 3/8" thick clear laminated glass with seamed edges
- 34" X 71 3/4" panel size
- 42" X 71 3/4" panel size

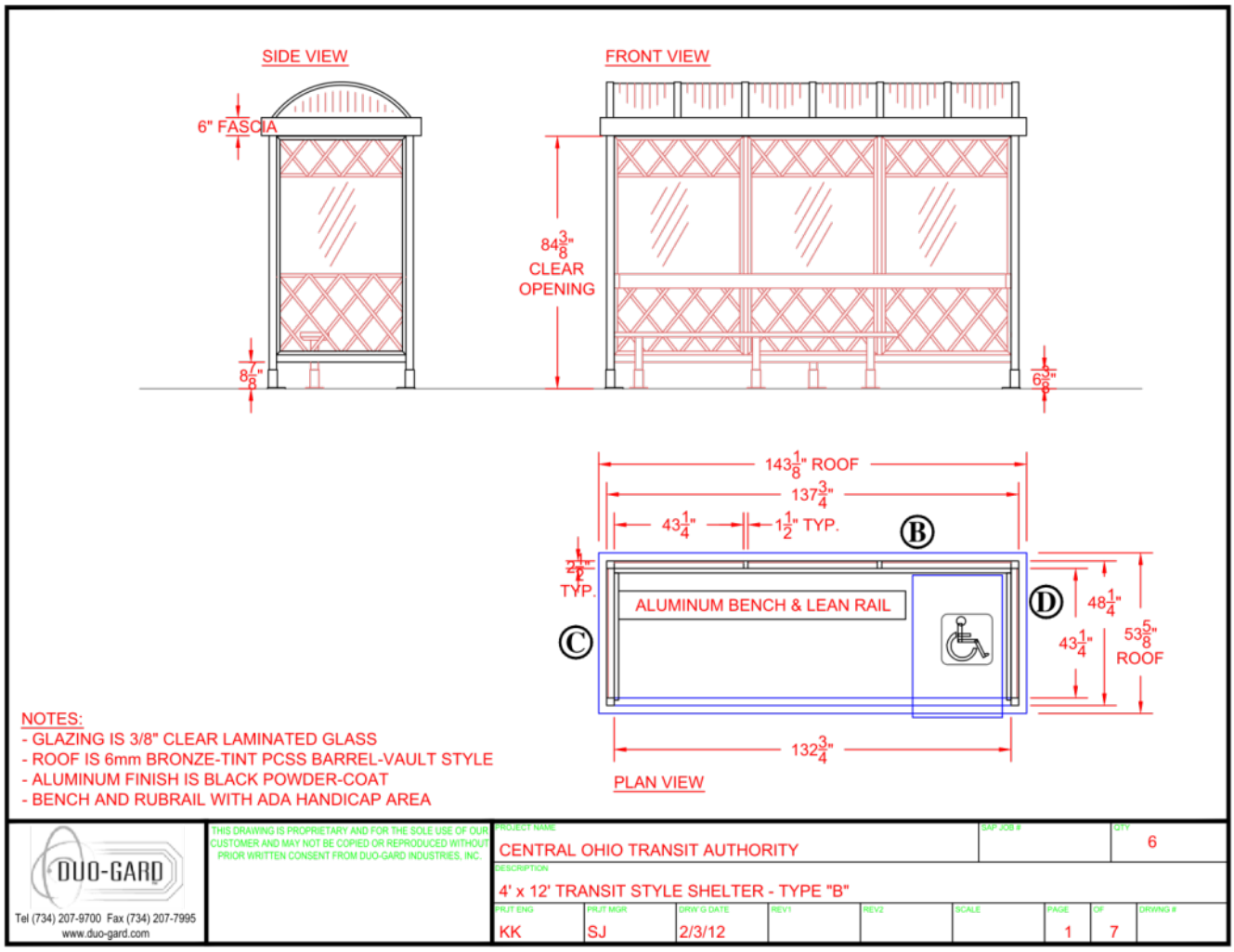


Figure 4-17 COTA Standard Full-Size Shelter

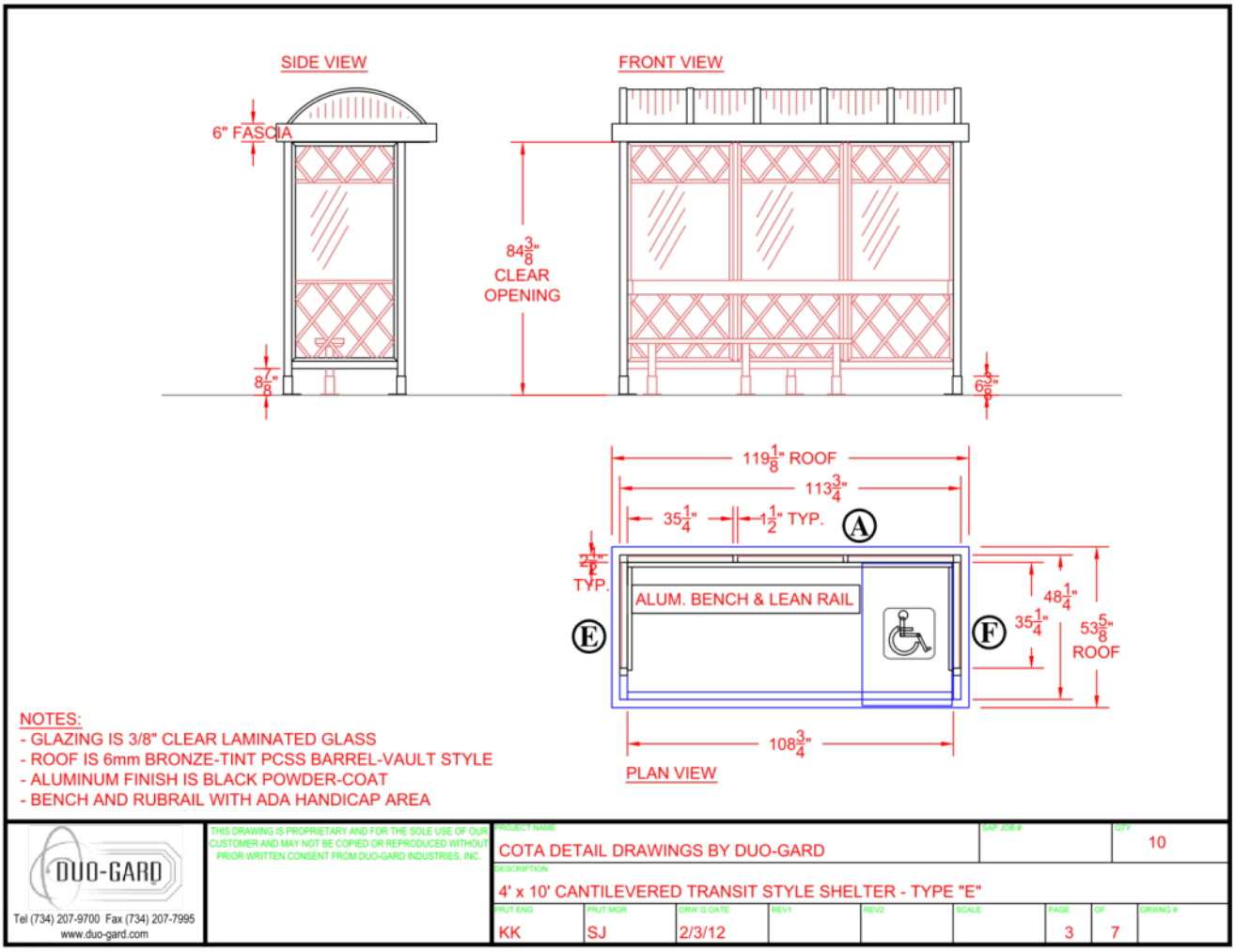


Figure 4-18 COTA Standard Half-Size Shelter

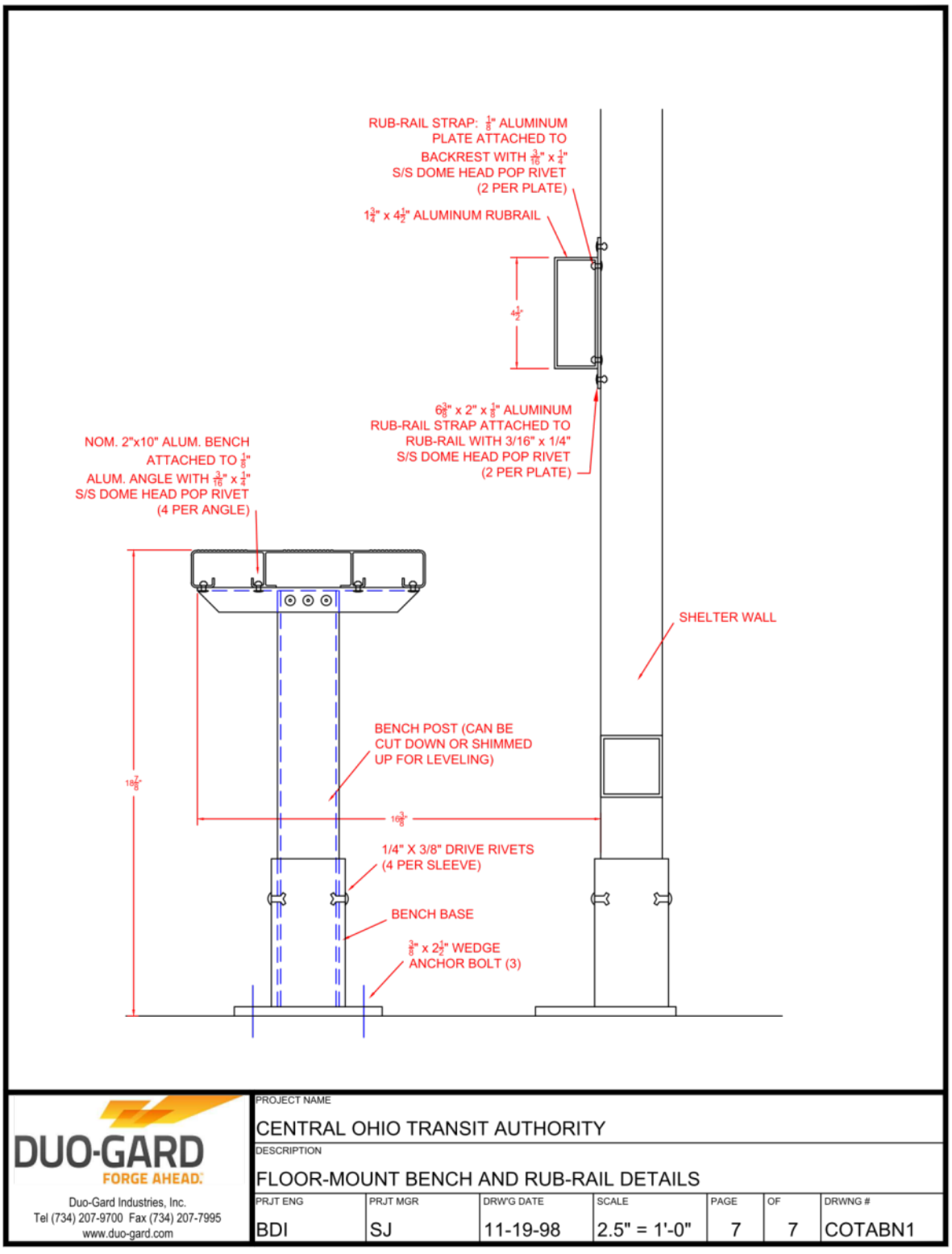


Figure 4-19 COTA Standard Shelter Bench and Rub-rail Detail

4.7.4 COTA High-Capacity Standard Shelters

COTA places high-capacity shelters in certain locations with significant passenger activity. These shelters can be placed in Downtown (other than High Street) or outside of Downtown. Figure 4-20 show the dimensions of this type of standard shelter.

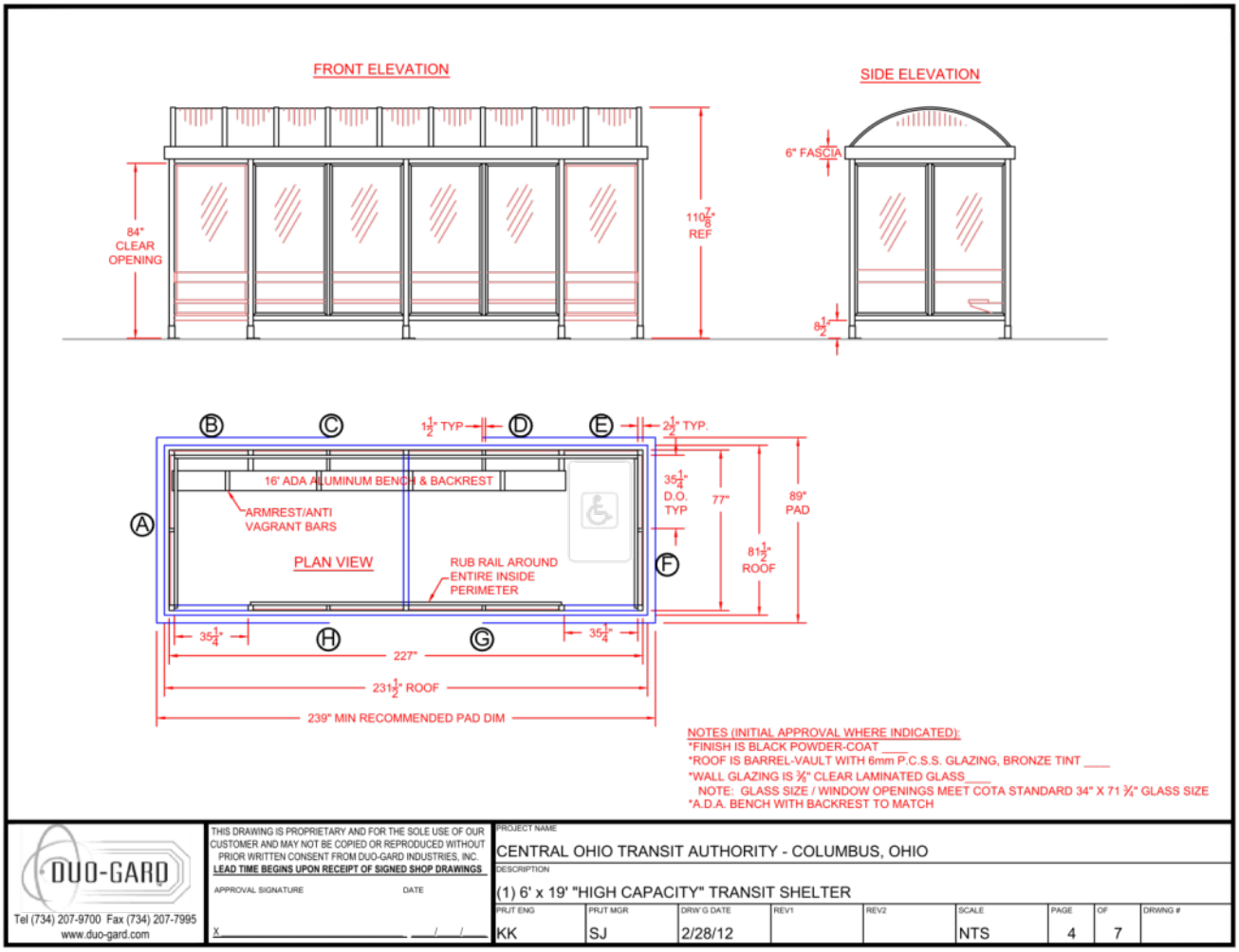


Figure 4-20 COTA Standard High-Capacity Shelter

4.7.5 Downtown High Street Shelters

COTA places special larger-capacity shelters along High Street in downtown Columbus, since these stops have much higher usage than any other part of the system and serve as important locations for transfers and system information. Recently, COTA worked with students from the Columbus College of Art and Design (CCAD) to design new bus shelters that will be installed in the central business district of downtown Columbus. The new contemporary shelters are illustrated in Figures 4-21 and 4-22.

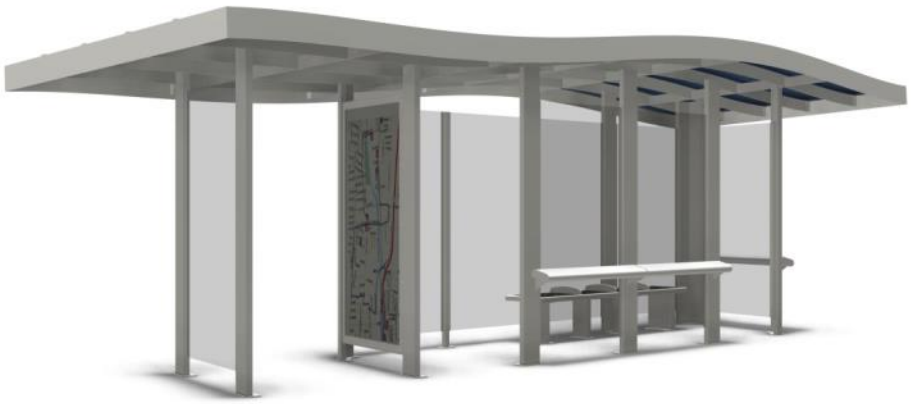


Figure 4-21 New Downtown Shelter Designed by CCAD Student

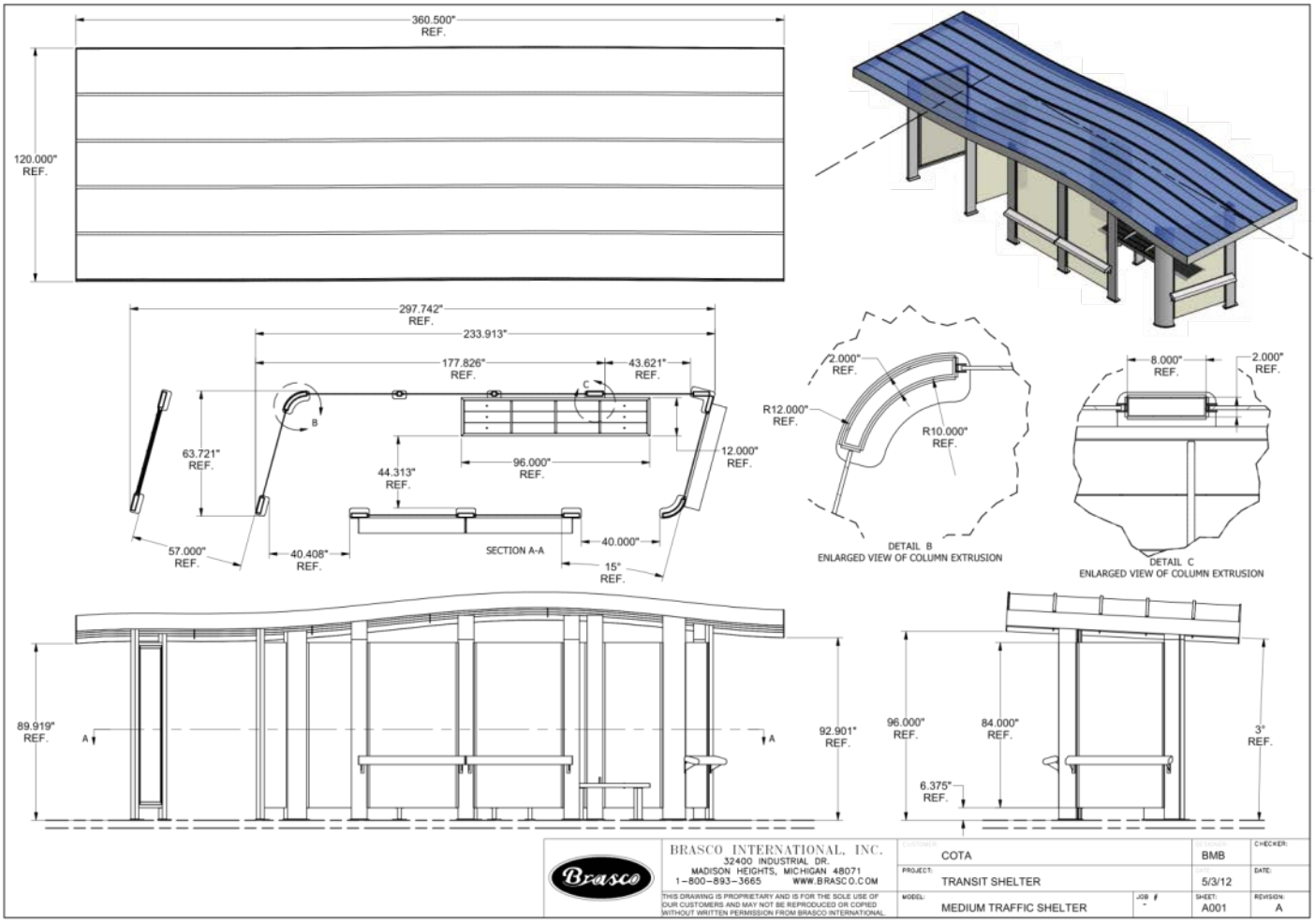


Figure 4-22 New Downtown Shelter Design Dimensions

4.7.6 Statehouse Shelters

In early 2012, COTA added the first bus shelters on Capital Square in downtown Columbus. These shelters, on South High Street and East Broad Street near the intersection of High and Broad Streets, are designed to complement the historic architecture of the Statehouse. These shelters are also designed for a larger capacity, due to the heavy ridership at these locations. Figure 4-23 shows the new Statehouse shelters in use.

Figure 4-23 Statehouse Shelter

4.8 Trash Receptacles

COTA places trash receptacles at most bus stop locations with shelters and at other high-ridership stops. COTA will consider placement of a trash receptacle at bus stop locations with 35 or more boardings per day. In limited and special cases, COTA may consider placing trash receptacles at stops where litter has become problematic, but only if it can be determined that COTA passengers are a major factor for the litter. COTA staff will have sole discretion in the final determination of trash receptacle placement. Trash receptacles should be installed where they do not create an obstruction or interfere with the accessibility of the bus stop or the adjacent sidewalk. Trash receptacles shall not be placed on the wheelchair landing pad or in the clear floor or ground space within the shelter. They must not obstruct pathways between the sidewalk, shelter access (where applicable), the landing area, or posted information. As mentioned previously, per section 403.5.1 of the DOT ADA Standards, the clear width of the pedestrian accessible route is permitted to be

reduced to 32 inches for a length of 24 inches by an obstacle such as a trash can. The receptacles should be secured to the pavement to prevent accidental tipping or unauthorized movement.

4.9 Lighting

Adequate lighting at bus stop facilities allows bus drivers and approaching traffic to see waiting passengers at night. Lighting also provides added security for those waiting at the stop, in addition to illuminating route and schedule information for patrons. Lighting can be provided by a nearby streetlight, ambient light from the adjacent businesses, lighting installed within the shelter, or a stand-alone light pole. Transit stops without sheltered lighting should be located within 50 feet of an overhead light source. Bus stop light fixtures or shelter illumination should be between 1.5 to 2.0 foot-candles. However, shelter lighting should be on the lower range as to not create a spotlight affect that makes it difficult for passengers waiting inside the shelter to see outside.

4.10 Bicycle Racks

COTA will incorporate bicycle racks into the design of COTA-owned facilities such as park & rides and transit centers when developing or renovating these locations. Municipalities and other parties may install bicycle racks near bus stops, as long as they do not obstruct or interfere with the accessibility of the bus stop or adjacent sidewalk. Bicycle racks should never be placed on the wheelchair landing pad, within the shelter, or blocking access from the shelter to the boarding area or access to the sidewalk network. Bicycle racks installed should conform to municipal standards.

4.11 Freestanding Benches

While benches are installed inside each of COTA's standard passenger shelters, COTA does not currently install freestanding benches at any of its bus stops. However, the installation of such benches may be considered in the future as a lower-cost option for bus stops that may not merit installation of a passenger shelter but could still benefit from the amenity of a place for passengers to sit. Boarding requirements and other criteria will be developed if and when COTA begins installing freestanding benches in the future.

Though COTA does not install any of its own freestanding benches, such benches do exist at or near several of COTA's bus stops. Many of these benches are "advertising benches."

4.11.1 Advertising Benches

Advertising benches have been placed in the City's rights-of-way for many years and the City of Columbus previously permitted those benches at specified locations. In the late 1980s, the City attempted to eradicate the benches from the right-of-way by confiscating all

the benches. The advertising bench owners brought suit and in a decision by the Tenth Appellate District, the court held that benches previously permitted in the right-of-way held a non-conforming status and that status could not be terminated if the bench does not constitute a nuisance or threat to the public, health, or welfare. (Bench Billboard Co. v. City of Columbus, 63 Ohio App. 3d 421, 579 N.E.2d 240 (1989).) Accordingly, the City of Columbus now has a list of approved locations for advertising benches or "grandfathered locations" where advertising benches are legally permitted.

Advertising Benches at Non-Permitted Locations

Where advertising benches are found at a non-permitted COTA bus stop location, the following actions will be taken:

- COTA will contact the Manager of the right-of-way & permit section of the Division of Planning and Operations at the City of Columbus and notify them of the non-permitted bench.
- The City will immediately remove and impound the illegally placed non-permitted bench.
- If the bench is not removed within 60 days of the report to City officials, COTA reserves the right to move the bench out of the bus stop area. If the bench is on COTA-owned property, it will be removed.

Advertising Benches at Permitted Locations

In locations permitted by the City, advertising benches are allowed to be placed in the vicinity of COTA bus stops. However, for operational effectiveness, adherence to requirements of the Americans with Disabilities Act, and ease of pedestrian access, COTA requests that the placement of advertising benches adhere to the following restrictions:

- Benches should not be located within 25 feet (in any direction) of a COTA bus stop (measured from the bus stop sign).
- Benches shall not obstruct pedestrian pathways to and from a COTA bus stop.
- Benches shall not be placed in the ADA passenger landing pad area.
- Benches shall not restrict access to the passenger shelter.
- Benches shall not be placed in a manner that interferes with passengers boarding or alighting buses at the front or rear door.

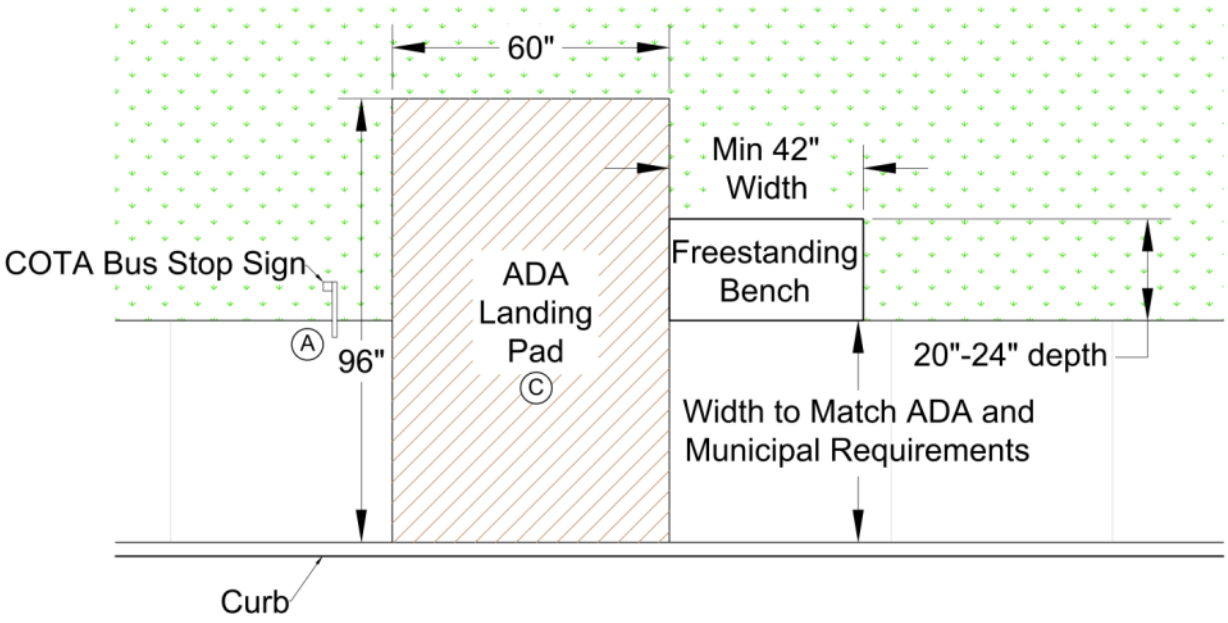
Because improper bench placement can pose difficulties for COTA's passengers, COTA reserves the right to move advertising benches to a more acceptable location if it is deemed necessary.

4.11.2 COTA Freestanding Benches

While COTA does not currently install freestanding benches, the Authority hopes to begin installing such benches at appropriate locations with average daily boardings of 35 or more.

This will provide better amenities to COTA's customers at a lower installation and maintenance cost. A standard bench design has not yet been chosen, but COTA recommends the following guidelines for freestanding benches located at bus stops:

- Dimensions: Seat should be 20 to 24 inches in depth and a minimum of 42 inches in length. Seat height should be 17 to 19 inches from the ground.
- Construction: Bench should be constructed of durable materials which are resistant to vandalism and weather conditions. Seat should be a slip-resistant surface that allows for proper drainage.
- Placement: Bench should not be placed on ADA landing pad, should not obstruct the sidewalk, and should be a minimum of 5 feet from the curb. Benches should be oriented towards the street.
- Bench design should discourage sleeping on the bench.



Ⓐ See Section 4.3 and Figure 4.4 for Bus Stop Sign Placement
Ⓒ Design slope 1.56%; As-built slope not to exceed 2.08%

Figure 4-24 Example Freestanding Bench at Bus Stop Design

4.12 Vendor Newspaper Boxes

Similar to other street furniture, vendor boxes should be placed so that they do not obstruct the sidewalk or ADA landing pad or interfere with passenger access to the bus, shelter, or customer information. Vendor boxes are not permitted to be located on COTA infrastructure. Vendor boxes in violation of these guidelines may be removed or relocated.

The use of vendor box "corrals" or fixed modular vendor boxes is encouraged in order to ensure that vendor boxes are placed and remain in appropriate locations.

4.13 Landscaping

Landscaping can enhance the level of passenger comfort and attractiveness at bus stops. However, landscaping should be done in such a way that the safety and accessibility of passengers are not compromised by encroaching bushes, uneven grass surfaces, shrubs, or planters. Ohio Revised Code requires cities to care for and control public rights-of-way, including keeping trees growing in the right-of-way adequately maintained to reduce or eliminate potential safety problems. Cities should perform hazard reduction pruning to provide pedestrian and vehicular clearance. Typically, tree branches that extend into the roadway should be trimmed back at least three feet from the curb to avoid damage to vehicles or trees. Landscaping features should not be placed within the ADA landing pad area and preferably not in the alighting area at the rear door of the bus. See section 6.2.2 for further discussion on pedestrian clear zones at bus stops. In order for operators to see customers, and for customers to feel safe at the bus stop, there should not be tall, dense, or overgrown landscaping in the immediate vicinity of the bus stop.

4.14 Maintenance

COTA strives to maintain bus stops so that they are safe and comfortable waiting environments. COTA is responsible for regular maintenance of the following amenities:

- COTA Route Identification Sign
- ADA Landing Pad installed by COTA
- Shelters (except where a maintenance agreement exists with an external party)
- Lighting within shelters
- Lighting on COTA-owned property (park & rides, transit centers, etc.)
- Information cases
- COTA-owned trash receptacles
- Bicycle racks on COTA-owned property (park & rides, transit centers, etc.)
- Landscaping of COTA-owned property (park & rides, transit centers, etc.)

External parties are responsible for the maintenance of the following amenities:

- No-parking signs (responsibility of municipality)
- Shelters where a maintenance agreement exists with an external party
- Street lighting
- Trash receptacles owned by municipalities or private parties.
- Bicycle racks not on COTA-owned property
- Landscaping not on COTA-owned property
- Other items not installed by COTA

5 Bus Stop Spacing

5.1 Spacing Guidelines

Bus stops should be spaced to balance the need for a quick in-vehicle travel time with considerations of the distance customers must walk to access the stop. When stops are spaced closely together, customers have convenient access as they are likely walking a short distance to the nearest bus stop. However, closely spaced stops are likely to result in a longer ride for customers because of the number of times the bus needs to decelerate, come to a complete stop, and then accelerate and re-merge into traffic. Having fewer stops along a bus route will inconvenience some customers who will be required to walk further to the nearest stop, especially if they have a mobility limitation. At the same time, having a greater distance between bus stops benefits passengers by reducing the in-vehicle travel time and benefits the transit agency through reduced maintenance costs of underutilized bus stops. Therefore, optimally spacing bus stops can have positive impacts on quality of service as well as operational effectiveness and efficiency.

COTA developed new bus stop spacing guidelines in 2009, as seen in Table 5-1 below. These guidelines were developed based on review of research studies on the optimal spacing of bus stops, existing bus stop spacing standards at other transit agencies, and feedback from the public, municipalities, and other stakeholders.

Table 5-1 Bus Stop Spacing Guidelines

Density/Land Use	Bus Stop Spacing Range
High density residential, Central Business District, commercial (>20 persons/acre)	500 – 700 ft.
Fully developed residential area (10 – 20 persons/acre)	700 – 850 ft.
Low density residential (3 – 10 persons/acre)	850 – 1200 ft.
Rural (or Express Bus Service) (0 – 3 persons/acre)	1200+ ft.

It is important to note that these are general guidelines and that the actual placement of bus stops is influenced by more than these factors. When placing new bus stops or analyzing existing stop spacing COTA examines the following criteria:

- Ridership – COTA will prioritize removing stops with low ridership rather than stops with very high ridership, which may result in uneven spacing on portions of the lines, if for example two very high ridership stops exist in close proximity to each other.

- Crosswalks- COTA will prioritize placing new stops at intersections with safe crosswalks to discourage unsafe pedestrian crossings, which may result in uneven stop spacing on portions of the lines.
- Accessibility – COTA may choose not to place or to remove stops along unsafe roadways with no pedestrian amenities, even if the spacing guidelines call for more closely spaced stops.
- Special Populations – COTA may place stops more closely together if the stops are in close proximity to concentrations of people with mobility limitations, elderly populations, or medical facilities.
- Nearby Destinations – COTA may place stops more closely than the guidelines call for if there are major trip-generating destinations such as employment centers.
- Transfer Opportunities – COTA may place stops more closely together than recommended if it is necessary to do so in order to make transfers possible between multiple lines.

5.2 Bus Stop Service Improvement Project

In 2010, COTA began a multi-year project to analyze all existing bus stops to determine if spacing is consistent with the new guidelines. Many of the communities in COTA's service area have changed over time and the existing bus stop spacing may not reflect current land use and population density. At least five months prior to each service change (the first Monday of January, May, and September), COTA selects routes to analyze, comprising about 500 bus stops. The spacing between each stop on each route is mapped and analyzed along with data collected from on-site investigations of each bus stop. Based on this analysis, COTA recommends bus stops to be consolidated, moved, or added. COTA uses a number of methods to notify customers and other stakeholders of these potential changes including:

- posting commuter bulletins on all potentially affected bus stops
- posting information on the COTA website
- holding public meetings
- notifying municipalities

Customers can respond during a three week open comment period through various methods, including the website, completing comment cards and verbally commenting at service change meetings, and phoning COTA to speak to a customer service representative. Based on the feedback received about the proposed bus stop changes, COTA will make the final decisions and notify the public of the final changes prior to implementation. It is expected that COTA will complete the Bus Stop Service Improvement Project by 2015.

6 On-Street Physical Characteristics

The size, weight, and operational characteristics of transit vehicles require special consideration in the design and construction process. Site layout and roadway design should incorporate the bus design and operational characteristics described in this manual. Proper design will enhance bus operations and traffic flow, help maintain roadway surfaces, and reduce obstacles for motorists, bicyclists, pedestrians, and bus operators.

Factors that should be considered when designing a site that will be served by COTA transit vehicles include:

- anticipated vehicle speeds
- traffic volume
- on-street parking conditions
- intersection radii
- bus dimensions
- presence of bicycle lanes
- sight distances
- land uses and surrounding development types (urban/rural)

The majority of COTA's bus stops are on-street bus stops that occur in the curb lane, a shoulder, or a parking lane. Dedicated transit facilities such as bus turnouts, bulbs, and turnarounds can also be incorporated into roadway designs to provide safe, off-street service points that do not interfere with traffic movement and help promote a vehicle's safe re-entry into traffic. These facilities should be designed to accommodate all of COTA's transit vehicles and allow for necessary vehicle acceleration and deceleration. Developers must contact COTA in the early stages of design and development before the installation of any type of bus stop. General illustrations of the different types of possible street-side bus stops are included in Figure 6-1.

The remainder of this chapter will be divided into sections that provide more specific information on the following subjects:

- General street design to accommodate transit vehicles
- Design of on-street bus stop zones
- Design of dedicated bus facilities (turnouts, bulbs, and turnarounds)

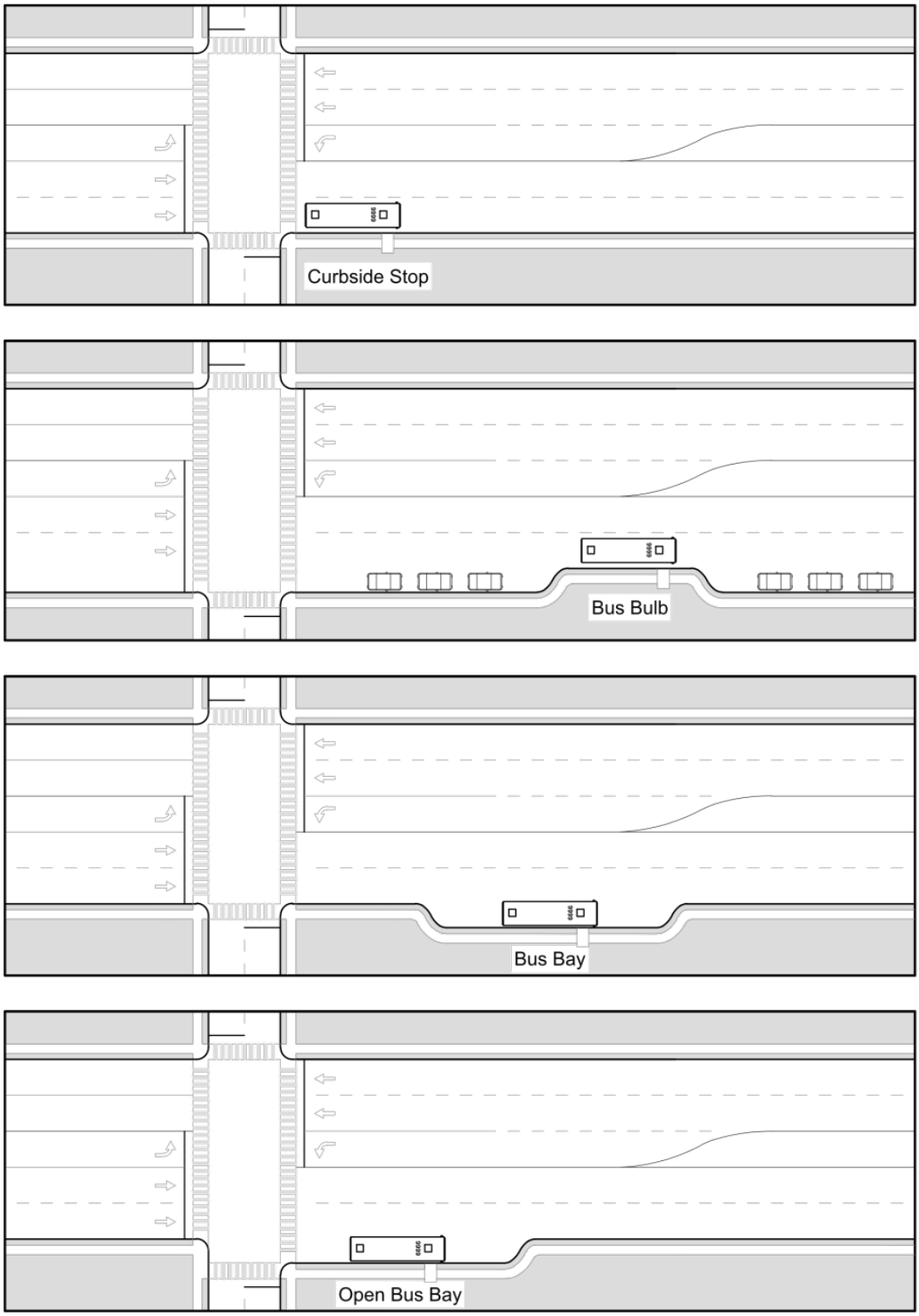


Figure 6-1 General Bus Stop Types

6.1 General Roadway Design for Transit Vehicle Use

Roadway width, grade, pavement design, traffic calming features, and curb detail are important factors to consider when designing for efficient and safe operation of COTA vehicles and the maintenance of roadway surfaces. COTA maintains a bus fleet containing buses of various sizes, and roadways should be designed to accommodate the maximum measurements of COTA's buses. Figure 6-2 illustrates the dimensions of COTA's standard 40-foot bus. Figure 6-3 illustrates the dimensions of COTA's 40-foot hybrid bus. These two buses represent the maximum dimensions of COTA's current bus fleet. This manual will be updated if and when a larger bus is introduced into COTA's fleet.

The maximum height of COTA's current fleet is 134 inches (11 feet, 2 inches); the maximum width (including mirrors) is 124 inches (10 feet, 4 inches); and the maximum length is 504.32 inches (42 feet). These dimensions represent the largest buses that COTA currently operates as of the writing of this document. In the future, COTA may add 60-foot articulated bus models to its fleet. These buses will exhibit different facility requirements due to their increased length and altered door placement (see Figure 6-4 showing dimensions of Cleveland RTA's current articulated bus). Developers should always contact COTA during the project planning process in order to receive more detailed vehicle fleet information as well as general plan reviews.

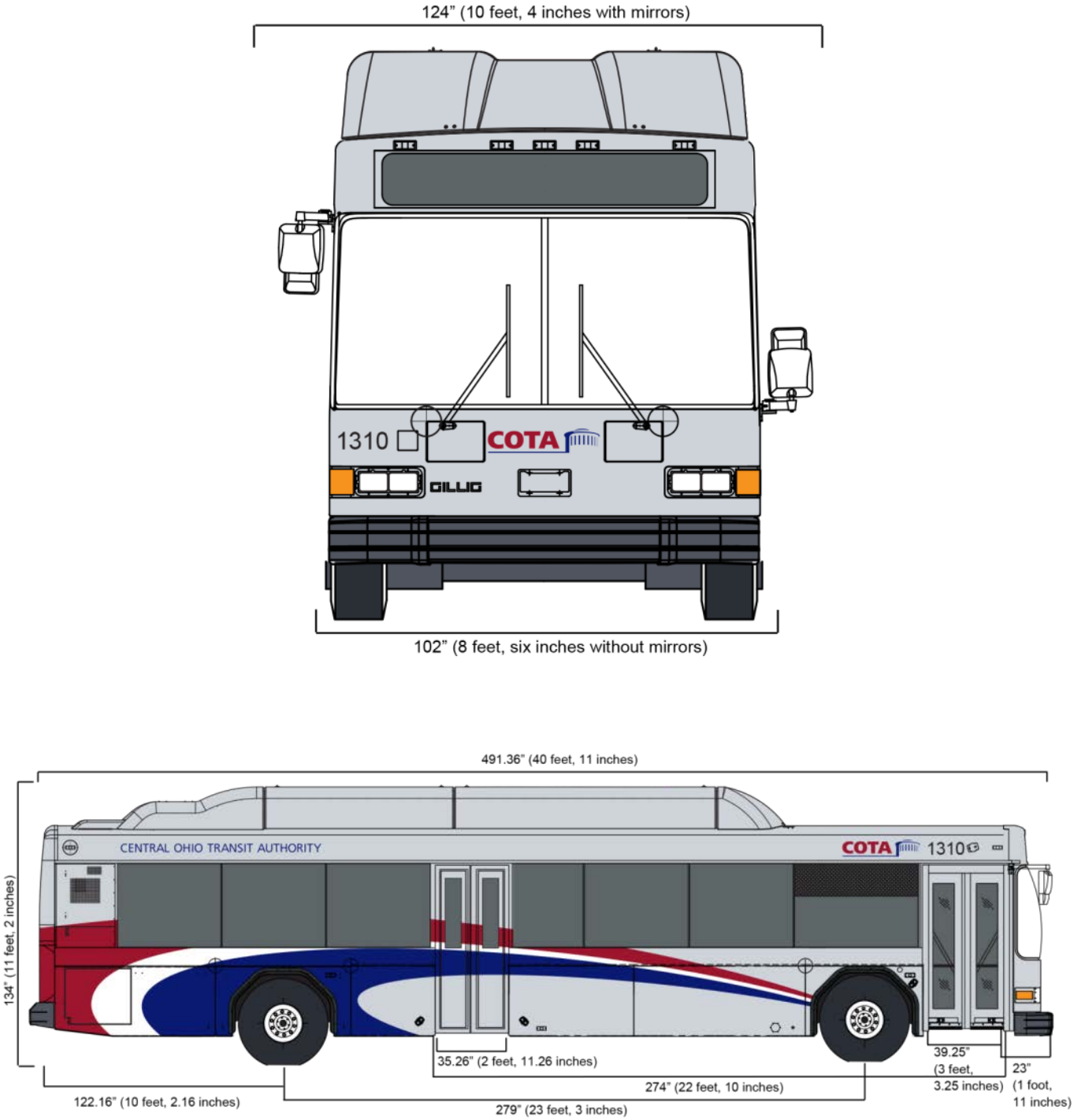
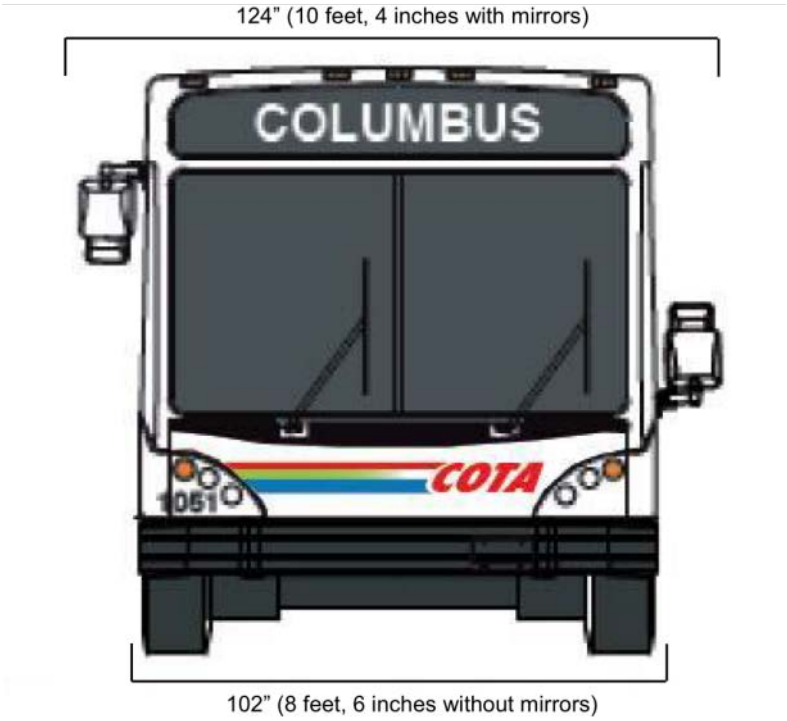


Figure 6-2 Dimensions of COTA CNG 40-Foot Coach



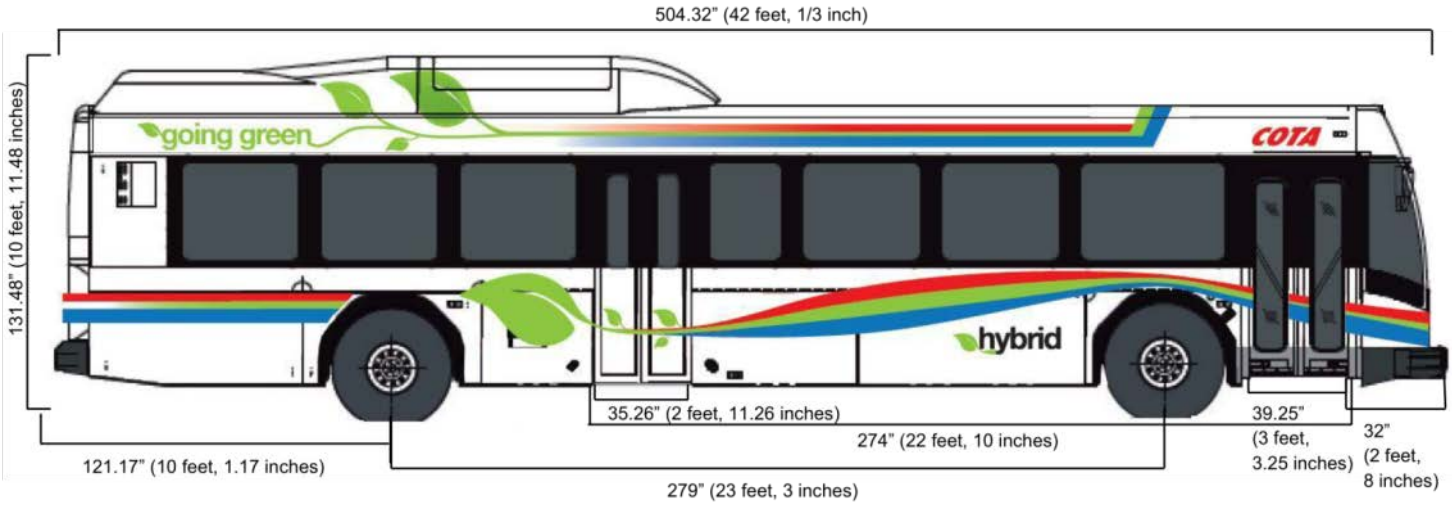


Figure 6-3 Dimensions of COTA Hybrid Coach

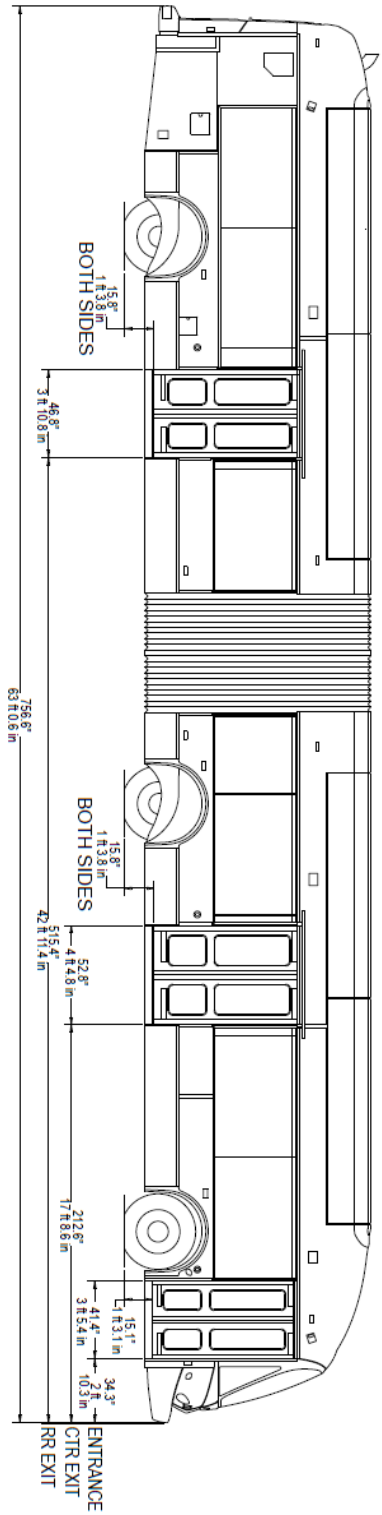


Figure 6-4 Example Dimensions of Articulated Bus (Courtesy of Cleveland RTA)

COTA recommends the following roadway design features that generally conform to or exceed Ohio Department of Transportation (ODOT) minimum design standards[4] while meeting COTA vehicle requirements. *These standards are not intended to supersede local regulations established by municipalities, counties, and DOTs*. These agencies should be contacted during the development and design stage to ensure compliance with local, state, and federal regulations.

6.1.1 Lane Width

COTA's buses operate most easily on lanes 12 feet or wider. However, this width is not always possible depending on the context of the roadway, and COTA buses do operate on roadways with lane widths less than 12 feet due to limited right-of-way. On public roads, lane width is decided by the appropriate municipality or jurisdiction. In private developments where COTA buses will operate, COTA recommends lane widths of 12 feet or more.

6.1.2 Roadway Grade

Changes in grade affect how well buses can easily negotiate changes in the roadway with adequate ground clearance for passenger safety and comfort. Changes in grade should be gradual (6% or less) to prevent buses from "bottoming out" or causing damage to the vehicle or roadway.

6.1.3 Roadway Pavement

For public roads, developers should follow appropriate state or municipal standards. However, if the roadway will be used by COTA vehicles, the pavement should be constructed to handle vehicles with a gross vehicle weight of 40,000 pounds. Table 6-1 shows the axle and gross vehicle weights (loaded) of COTA's current heaviest buses as well as a 60-foot articulated bus model used by the Port Authority of Allegheny County (as example).

Table 6-1 Axle and Vehicle Weights for COTA Bus Models and Example 60-foot Model

BUS MODEL	GROSS AXLE WEIGHT RATING-FRONT	GROSS AXLE WEIGHT RATING-MIDDLE	GROSS AXLE WEIGHT RATING-REAR	GROSS VEHICLE WEIGHT RATING
Gillig 40 Ft	14,600 lbs		25,000 lbs	39,600 lbs
Gillig Hybrid 40 Ft	14,600 lbs		25,000 lbs	39,600 lbs
Gillig CNG 40 Ft	14,600 lbs		27,000 lbs	41,600 lbs
Neoplan 60 Ft (Port Authority)	15,000 lbs	26,000 lbs	28,600 lbs	69,600 lbs

[4] http://www.dot.state.oh.us/Divisions/Engineering/Roadway/DesignStandards/roadway/Pages/locationanddesignmanuals.aspx

For private roads that will be served by COTA's transit vehicles, it is again recommended that pavement be constructed to handle vehicles with a gross vehicle weight of 40,000 pounds and the axle loads specified above. Though specific pavement design will be up to the developer and will depend on soil conditions, in order to hold up to regular use by transit vehicles, COTA recommends that developers follow the City of Columbus' Non-Residential Street Pavement Policy. Pavement type and quality is especially important for areas that must withstand regular and frequent bus starting and stopping movements. Note that COTA assumes no responsibility for pavement damage on private property unless specified in a license agreement.

6.1.4 Concrete Bus Pads

For heavily-used bus stop areas, including bus turnouts and terminals, the rigid pavement design is strongly recommended. Due to the loads and shear forces applied to pavement surfaces during bus starting and stopping movements, this pavement surface has the best potential to retain its shape and resist breaking down over time. The City of Columbus standards for concrete bus pads are shown in Figures 6-5 and 6-6.

The installation of concrete bus pads is up to the discretion of the appropriate municipality. The locations of recommended concrete pads will be influenced by bus frequency, speed, and existing pavement condition. Concrete bus pads should be installed to be the width of the curb lane and preferably extend the entire length of the appropriate bus stop zone (as discussed further in section 6.2). Thus, the concrete pads should be at least 125' long for near-side bus stops, 125' long for far-side bus stops, and 150' long for mid-block bus stops. In areas where more than one bus will arrive at the bus stop at one time, the length of the concrete pad should be extended by at least 50' for each additional expected bus (70' for each articulated bus). COTA should be consulted to determine the number of buses expected to arrive or dwell at a bus stop simultaneously.

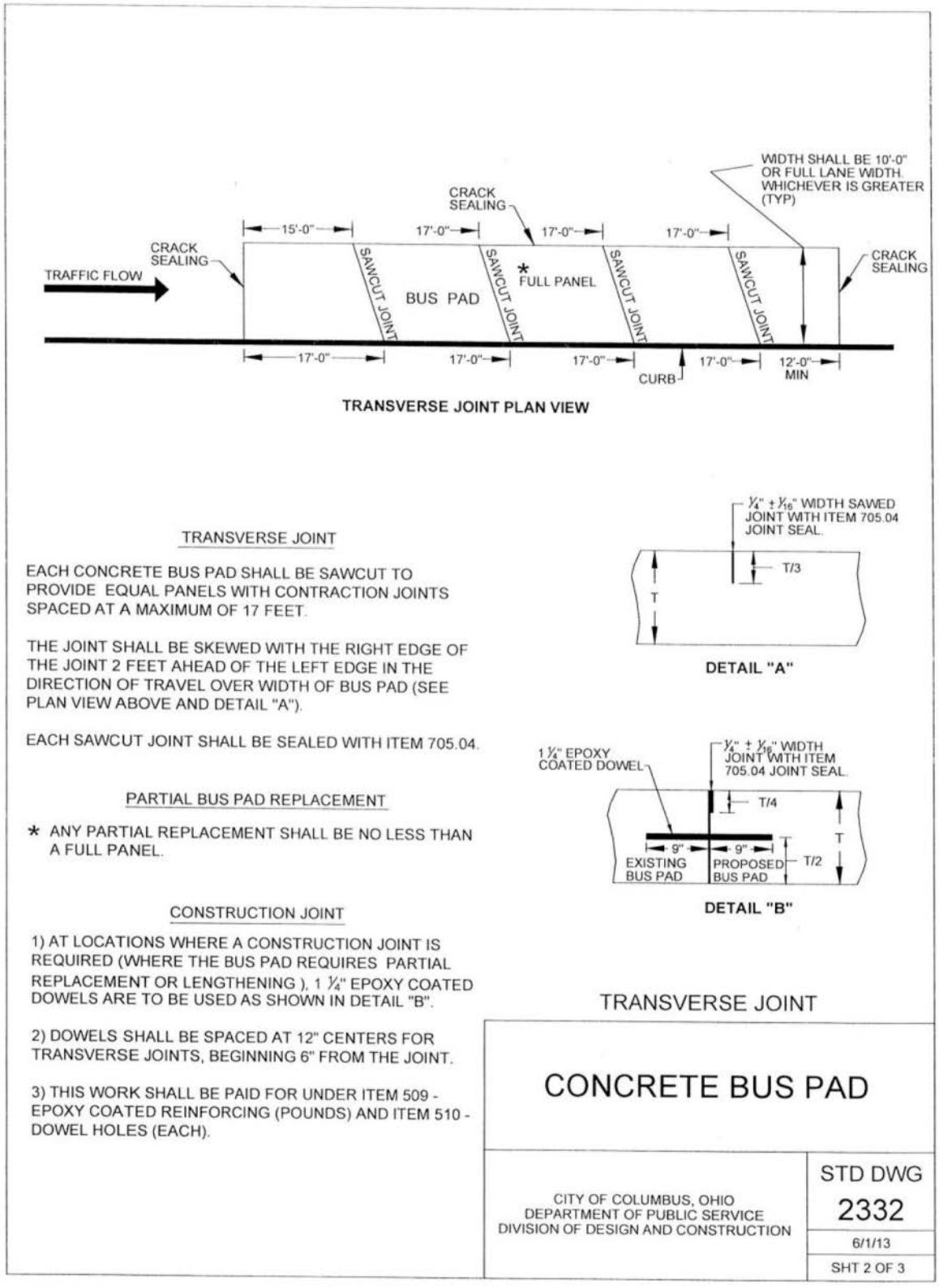


Figure 6-5 Concrete Bus Pad Top View
Source: City of Columbus

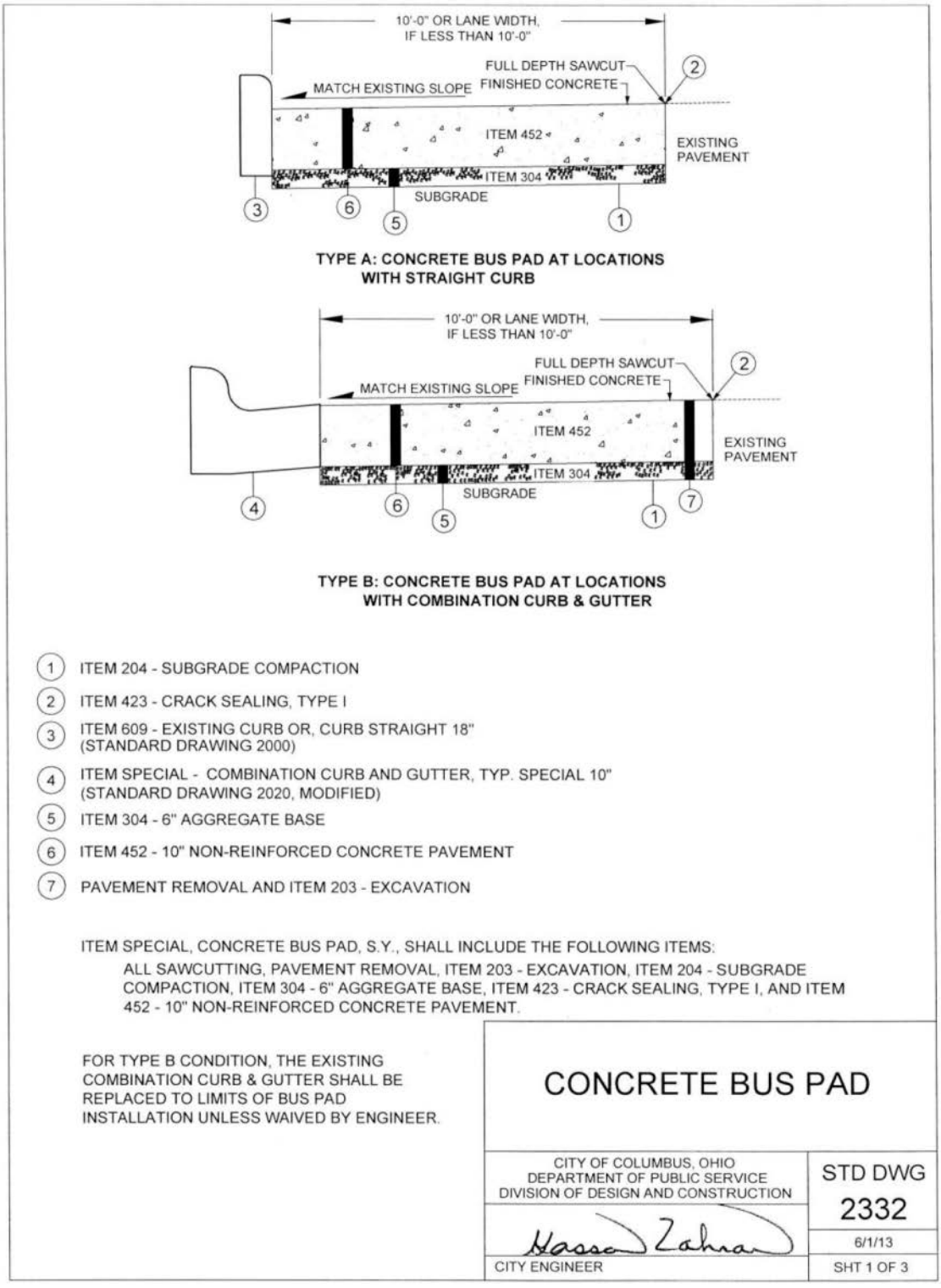


Figure 6-6 Concrete Bus Section
Source: City of Columbus

6.1.5 Curb Height

COTA recommends a curb height of 6 to 8 inches. This is desirable to achieve easy boarding and alighting movements for bus passengers, especially those with mobility limitations. Curb heights must be in compliance with municipal standards.

6.1.6 Turning Radii

The turning radius of COTA's transit vehicles affects the design of intersections, roundabouts, and dedicated bus facilities such as turnarounds and park and rides. While the curb radius and other roadway design features of municipal streets is governed by the appropriate municipality, the typical turning radius of COTA's vehicles should be considered, as it will affect the ability of COTA to operate safely on roadways with minimal encroachment into other lanes of traffic. Private developments that are intended to receive bus service should design facilities that will accommodate smooth and easy turning movements by COTA's vehicles. Such developments should be designed to accommodate a 30-foot inner turning radius and 60-foot outer turning radius.

6.1.6.1 Curb Radii

The corner curb radii used at intersections can affect bus operations when the bus makes a right turn. Some advantages of a properly designed curb radius are as follows:

- Less bus/auto conflict at heavily used intersections (buses can make turns at higher speeds and with less encroachment)
- Higher bus operating speeds and reduced travel time
- Improved bus patron comfort
- A trade-off in providing a large curb radius is that the crossing distance for pedestrians is increased

The design of corner curb radii should be based on the following elements:

- Design vehicle characteristics, including bus turning radius
- Width and number of lanes on the intersecting street
- Allowable bus encroachment into other traffic lanes
- On-street parking
- Angle of intersection
- Operating speed and speed reductions
- Pedestrians

On municipal streets in urban areas, comfortable curb radii and turning radii for transit buses cannot always be achieved. However, as AASHTO's "Guide for Geometric Design of Transit Facilities on Highways and Streets" notes, smaller curb radii result in buses having to pull further into the intersection and occupying more than a single lane width on the

intersecting street. Such factors have to be considered in decisions regarding both roadway design and operational practices. Figure 6-7 below shows the turning radius template provided by COTA's bus manufacturer for its standard 40-foot bus. This template shows the absolute minimum inner and outer radii that a bus turning movement would require. However, in real-life situations, bus operators can rarely achieve these dimensions.

Figure 6-8 shows appropriate curb radii values for transit vehicles and varying lane configurations. This drawing should serve as a starting point, though municipal intersection design will be determined by the appropriate design standards for each case.

Figures 6-9 and 6-10 show the results of using AutoTURN software to demonstrate the actual path that a turning bus takes when attempting to make a right turn from a 12-foot lane into another 12-foot lane. Figure 6-9 represents an intersection with a 30-foot curb radius whereas Figure 6-10 represents a 35-foot radius. In both situations, the bus' turning path swings into the left-turn lane of oncoming traffic. This situation occurs frequently in urban areas, and though minor levels of encroachment may be acceptable in low-volume, low-speed situations, this is a topic that should be considered in the design of any intersections that will accommodate transit vehicles. In some situations, such as what is shown in Figure 6-10, the bus encroachment issue can be solved by simply moving the stop bar further back.

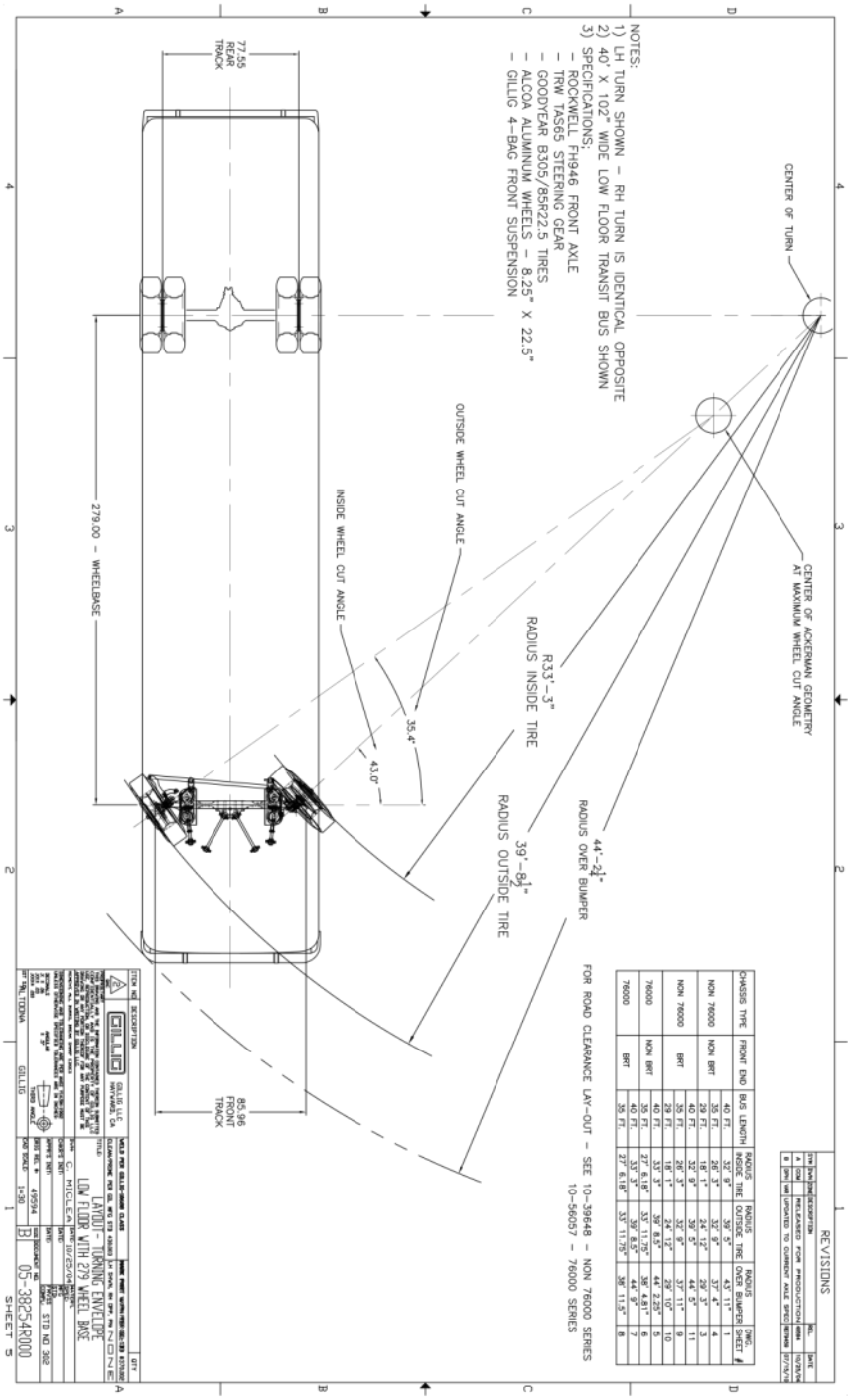


Figure 6-7 Gillig Bus Left Turn Turning Radius

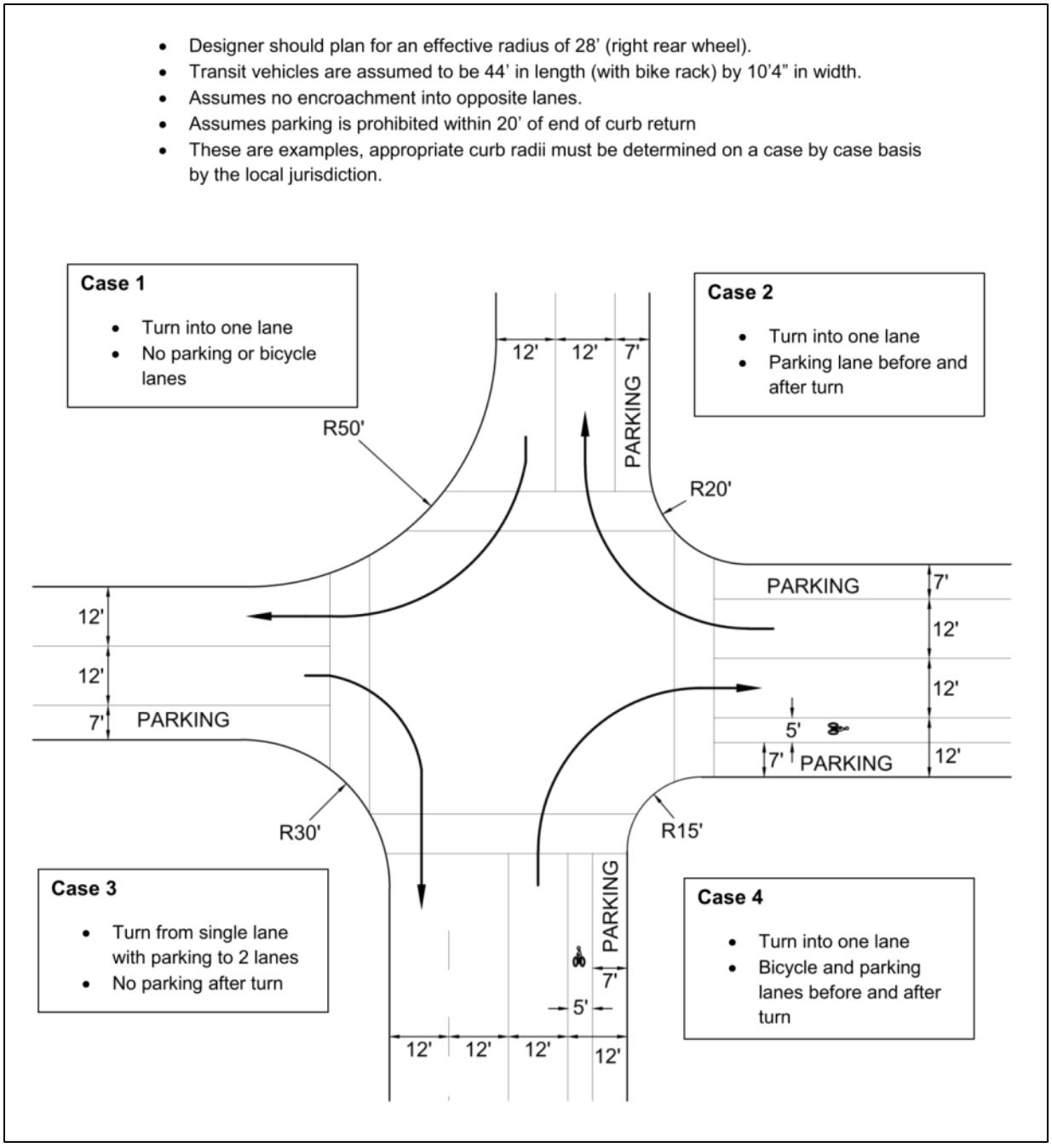


Figure 6-8 Ideal Curb Radii Design for Transit Vehicles

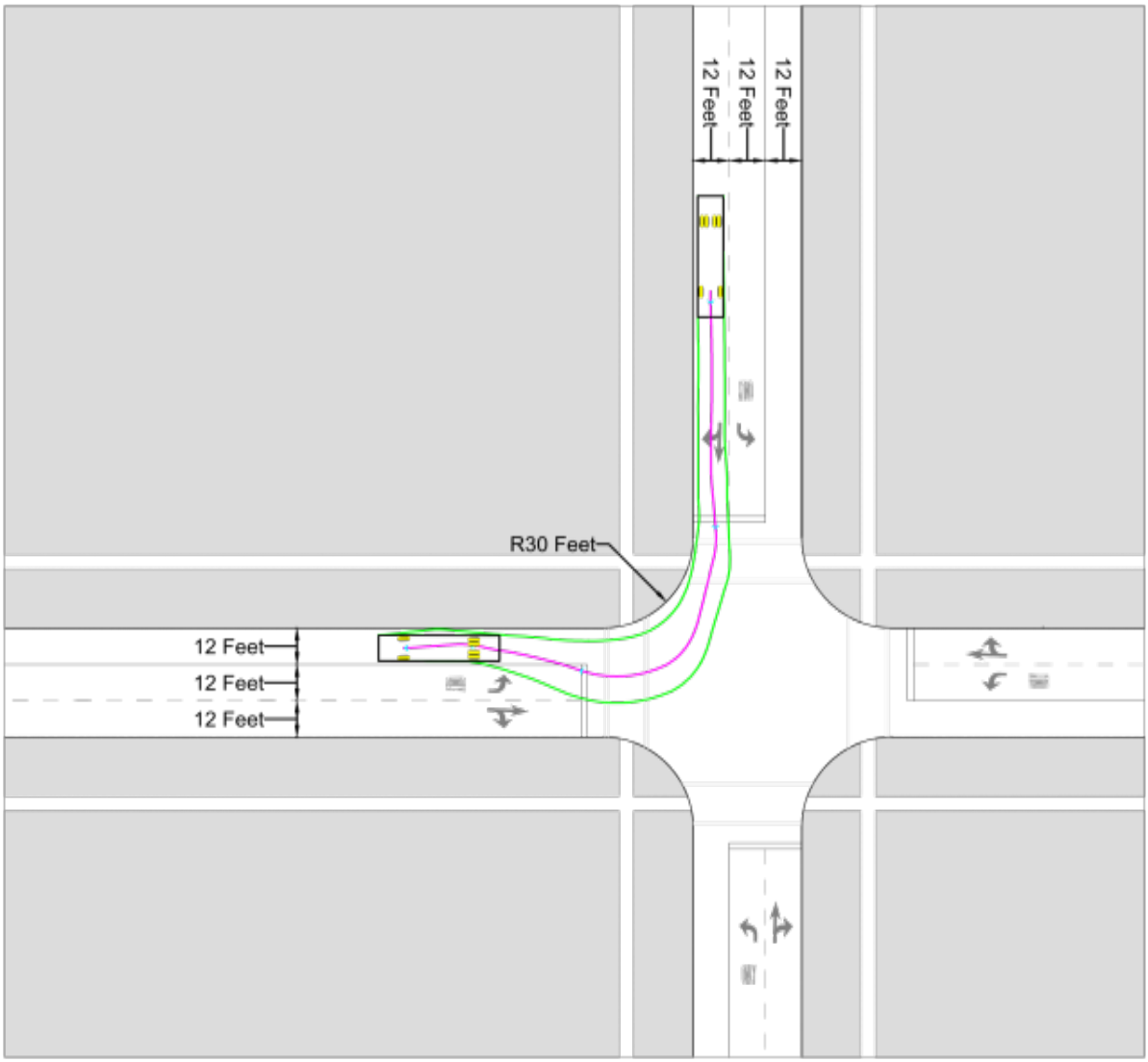


Figure 6-9 Example Bus Turning Movement with 12-foot Lanes and 30-foot Curb Radius

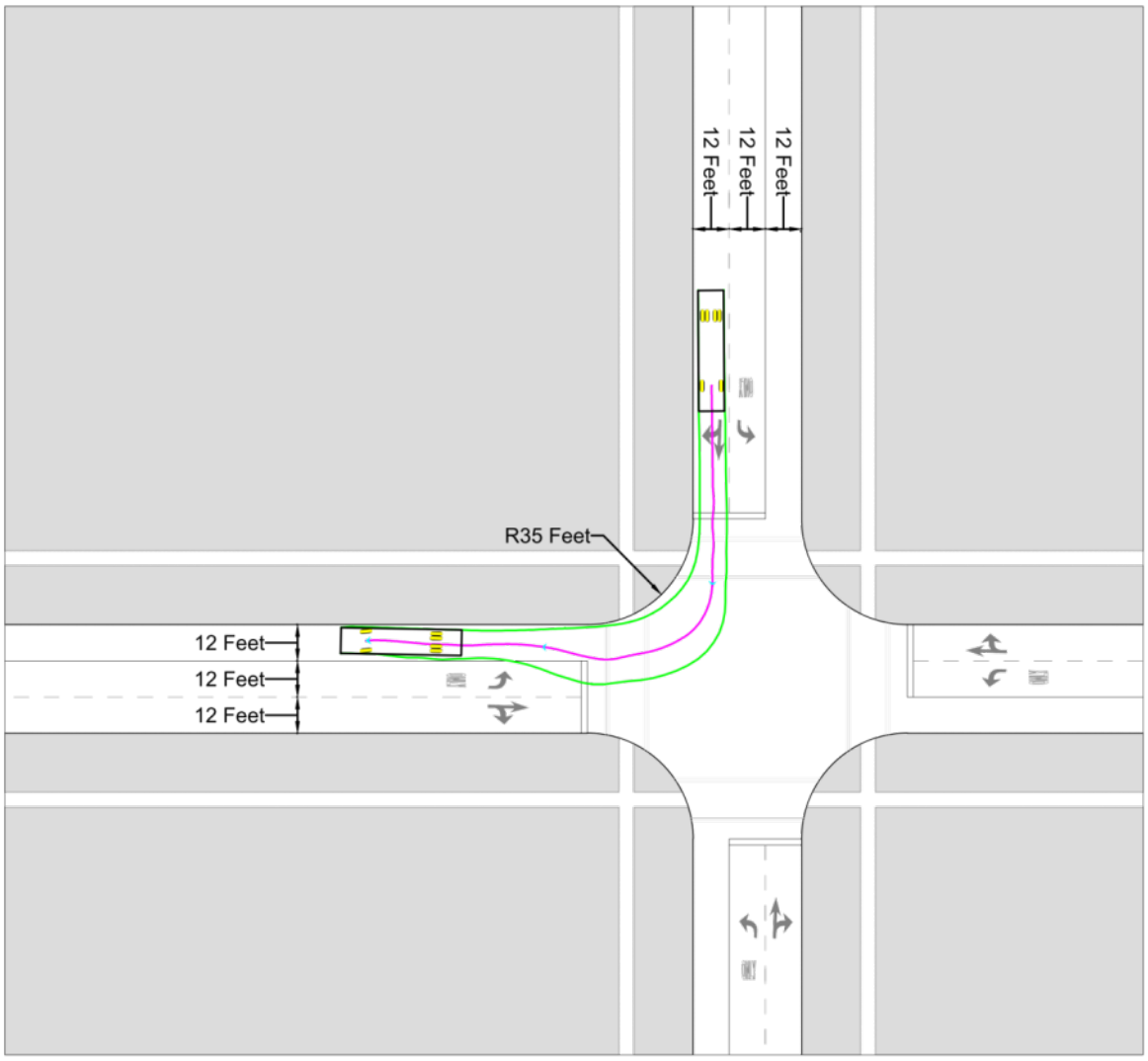


Figure 6-10 Example Bus Turning Movement with 12-foot Lanes and 35-foot Curb Radius

6.1.6.2 Turning Radii at other Facilities

Bus turning radii should also be considered in the design of roundabouts, especially those that accommodate multiple lanes of traffic. Buses exhibit longer stopping and starting times, and thus entering roundabouts and maneuvering through them can be challenging for bus operators. Additionally, pedestrian signage placed between the lanes of traffic is likely to be hit by buses as they move through the roundabout. While there are many factors that influence the radii, lane widths, and traffic design of roundabouts, the size and turning radius of COTA's buses should be included as one factor so that COTA's ability to operate through the roundabout is ensured.

When designing roundabouts or other turnaround locations that will be served by COTA's vehicles, developers must prove to COTA that the locations will accommodate COTA's transit vehicles. This should be proven by graphically showing that COTA's buses can make the specific maneuver. Use of Auto TURN or other comparable computer programs is recommended. This is especially important in locations where vehicles will be required to pass other vehicles or obstacles. An example of Auto TURN results from COTA's North High Street turnaround location is included in Figure 6-11 below.

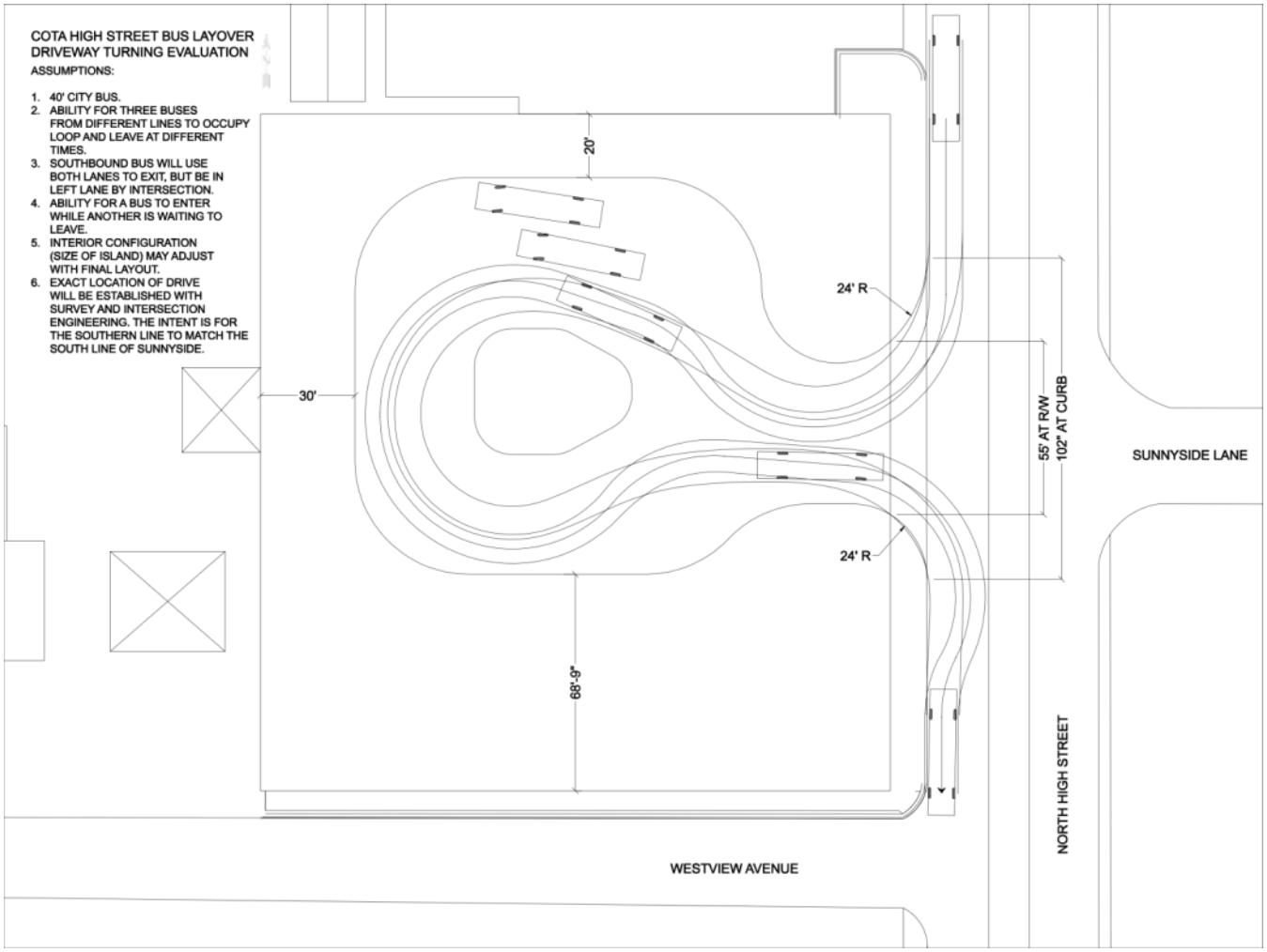


Figure 6-11 Example Auto TURN Results for Multiple-Bus Turnaround Location

6.1.7 Clearance Requirements

Buses usually travel in the curbside traffic lane and make frequent stops to pick up and drop off passengers. Therefore, it is important to consider bus clearance requirements in the design of the roadway environment.

- Overhead obstructions should be a minimum of 13 feet above the street surface.
- For future street improvements, obstructions (including bus stop signs) should not be located within a minimum of two feet of the edge of the street to avoid being struck by a bus mirror or the overhang of the vehicle body. (This lateral clearance is not only important at ground level, but it is also necessary at the top of the bus.)
- A traffic lane used by buses should be wide enough to permit adequate maneuvering space and to avoid sideswipe accidents. Since the maximum bus width including mirrors is 10'-4", the desirable curb lane width (including the gutter) is 12 feet or greater, though narrower lane widths will often exist in urban areas. Transit vehicles will still be able to operate on roadways with lane widths as small as 10 feet, but narrower lanes introduce a greater possibility of bus-vehicle conflicts and turning movement complications.

As stated at the beginning of this section, the road design and construction requirements at the federal, state, and local level should always be followed. In many cases, however, the guidelines included in this section go above and beyond typical roadway requirements and should be followed in order to best accommodate transit vehicles and patrons.

6.1.8 On-Street Bicycle Lanes

Whenever a bus stop is placed where there is a striped bicycle lane on the roadway, the bicycle lane striping must be changed to a dotted line for the entire length of the bus stop zone. This will allow the bus to cross over the bicycle lane to reach the curb legally and will also alert bicyclists to the movement of transit vehicles into the bicycle lane area. The picture below shows an example of bike lane dotting throughout a bus stop zone in the City of Columbus. Specific requirements for bike lane striping and dotting may vary by municipality.

Additionally, COTA must be contacted whenever a bicycle lane or sharrow will be newly-marked on a roadway. These installations can have an impact on COTA's bus operations, especially if the bicycle treatment on the roadway will narrow or reduce the number of traffic lanes.

Figure 6-12 Bike Lane Dotting at Bus Stop Zone

6.2 On-Street Bus Stop Zones

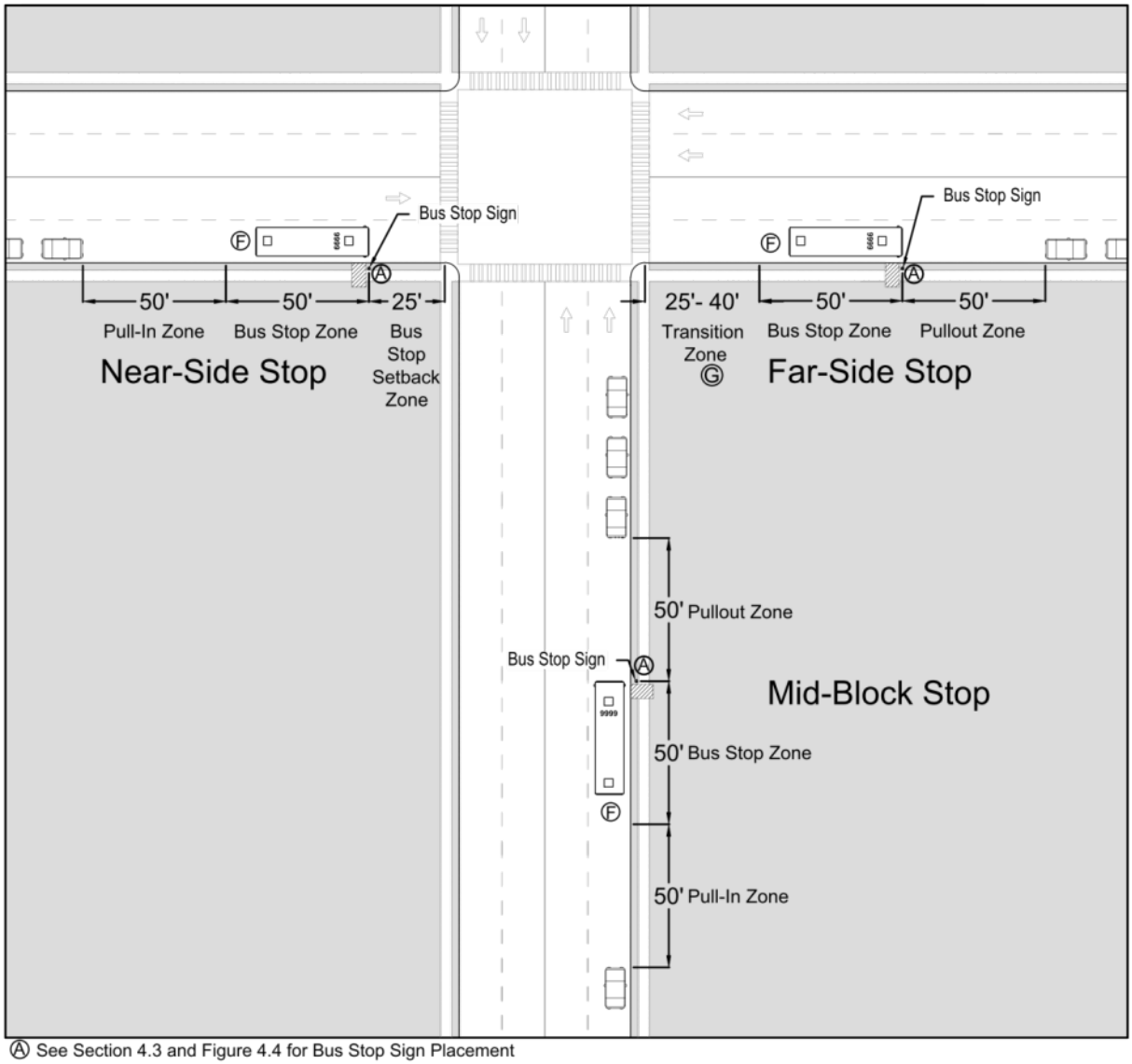
6.2.1 Streetside Considerations

As described in Chapter 3, on-street bus stops are generally placed in one of three locations: near-side of the intersection, far-side of the intersection, or mid-block (between two intersections). On-street bus stops in the traffic lane are most appropriate on roadways with a speed limit of 35 mph or less. On higher-speed roads, bus bays (or turnouts) may be preferred for the safety of pedestrians, bus operators, and drivers. However, specific traffic conditions and existing right-of-way constraints will dictate what type of bus stop should be installed.

Figure 6-13 illustrates the three on-street bus stop locations along with measurements for parking setbacks. The measurements shown in Figure 6-13 illustrate the desired "clear zone" that should be provided at each bus stop location to provide for the safe movement of buses into and out of the parking or curb lane (20 feet should be added to each clear zone that will accommodate articulated buses). This clear zone is necessary when parking or other obstructions are located in the same lane in which the bus will be stopping. On roadways with only one thru-lane, bus stop zones should still be demarcated on either end by "no stopping" signs, as shown in Figure 6-14. COTA realizes that these clear zones are not always possible given existing site conditions. However, these dimensions should be pursued to the extent possible, and COTA should be contacted when designing bus stop zones so that operational data can be used to estimate necessary space requirements.

Note that measurements given in the following illustrations only apply to bus stop zones where one bus at a time is expected in the zone. In other locations, where more than one bus may arrive and dwell at the same time, additional space is needed. In general, bus

zones should increase by 50 feet for each additional standard bus and 70 feet for each additional articulated bus that is expected to use the zone simultaneously.



Ⓐ See Section 4.3 and Figure 4.4 for Bus Stop Sign Placement
Ⓕ Add 50' to Bus Stop Zone for Each Additional Pass-Through Bus or 70' for Each Additional Pass-Through Articulated Bus
Ⓖ 25' Minimum for Straight-through Movement
40' Minimum After Right Turn

Figure 6-13 On-Street Bus Stop Zones (No-Parking Zones) Recommended for Roadways with Speed Limits of 35 mph or Less

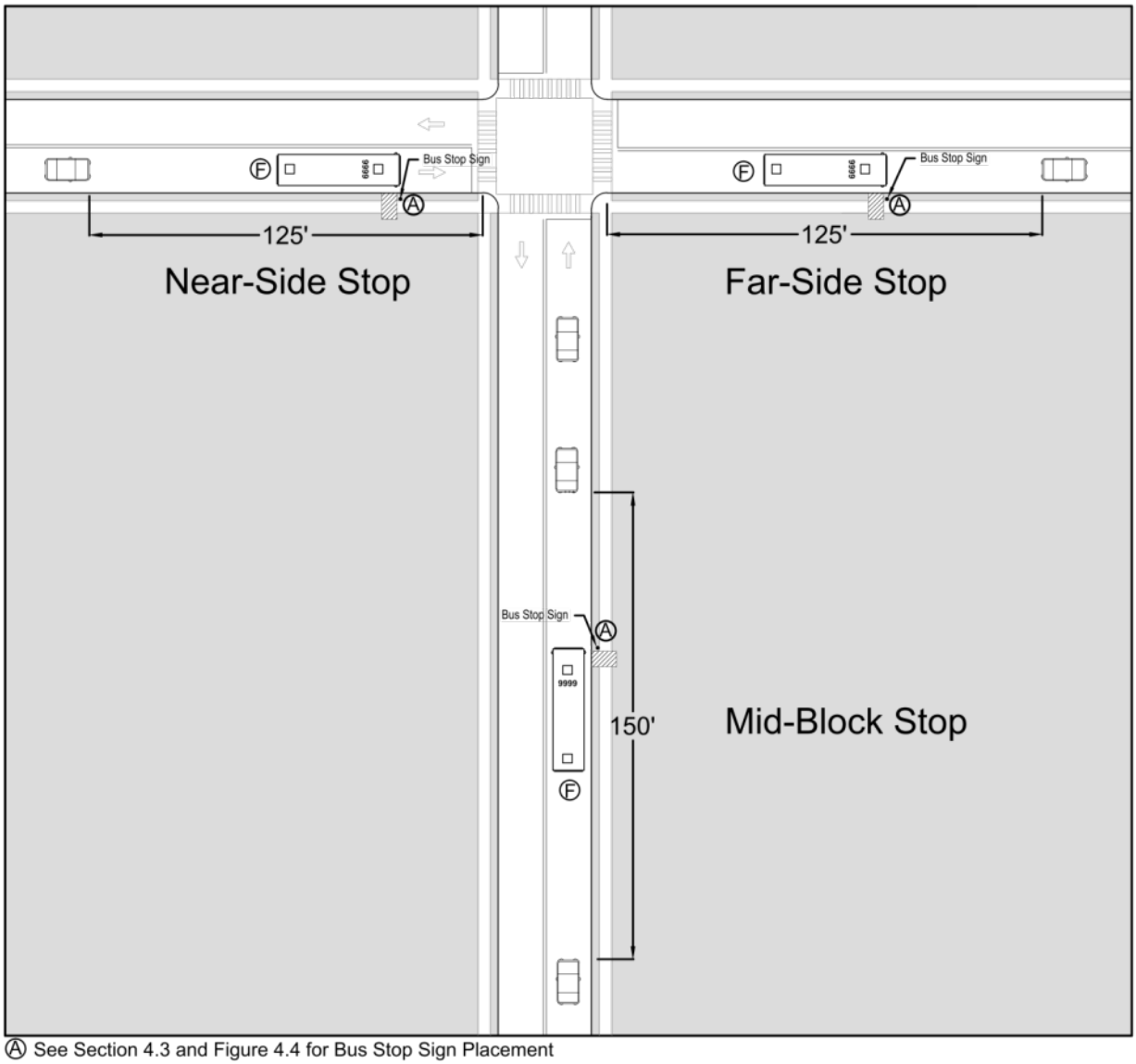


Figure 6-14 Bus Stop Zone Guidelines on Roadways with One Through-Lane

6.2.2 Pedestrian (sidewalk) Side Considerations

A clear zone on the pedestrian side of the curb should also be provided to allow for the safe and convenient boarding and alighting of passengers from both the front and rear doors of the bus. The boarding and alighting area required by the Americans with Disabilities Act is only mandated where a wheelchair lift is located on a bus (at the front door only of COTA buses) and is addressed in detail in Chapter 4. However, passengers should be able to safely alight from the rear door of the bus, and thus COTA recommends a generally clear sidewalk (or other level and stable surface) space of at least 30 feet for each bus stop zone. This will accommodate the total distance from the front of the front door to the back of the rear door of the bus for COTA's current bus fleet, while still allowing space for streetscaping features. An illustration of how this clear zone can be achieved alongside streetscaping features is shown in Figure 6-16. Figure 6-17 shows the same concept with a streetscaping scheme that incorporates a grassy strip. These figures show a 20-foot "streetscape zone," which is the area between buses where streetscaping features can be installed close to the curb without interfering with bus passenger boarding and alighting movements.

For COTA's heavily-used routes, however, it is recommended that bus stop zones be designed to accommodate 60-foot articulated buses as well as standard 40-foot buses because of the likelihood that COTA may acquire articulated buses in the future. The general areas that should be designed for possible multiple-stop zones with articulated buses are illustrated in Figure 6-15 and include:

- Downtown (bounded on the north by I-670, the south by I-70, the east by I-71, and the west by SR-315)
- Line #1
- Line #2
- Line #10

For areas that may accommodate several buses of different sizes in the future, a different streetscaping concept is recommended. This concept, shown in Figure 6-18, relies on ADA-compliant tree grates (flush with the ground) rather than elevated streetscaping features to allow for bus stop boarding and alighting areas to fall anywhere within the entire bus stop zone. With this design, even if the back door of a bus falls in line with a street tree, passengers will still be able to safely alight the bus, assuming that the tree itself is set back far enough from the curb. This same result can also be achieved by setting streetscaping features further back from the curb so that they do not interfere with passengers boarding and alighting the bus.

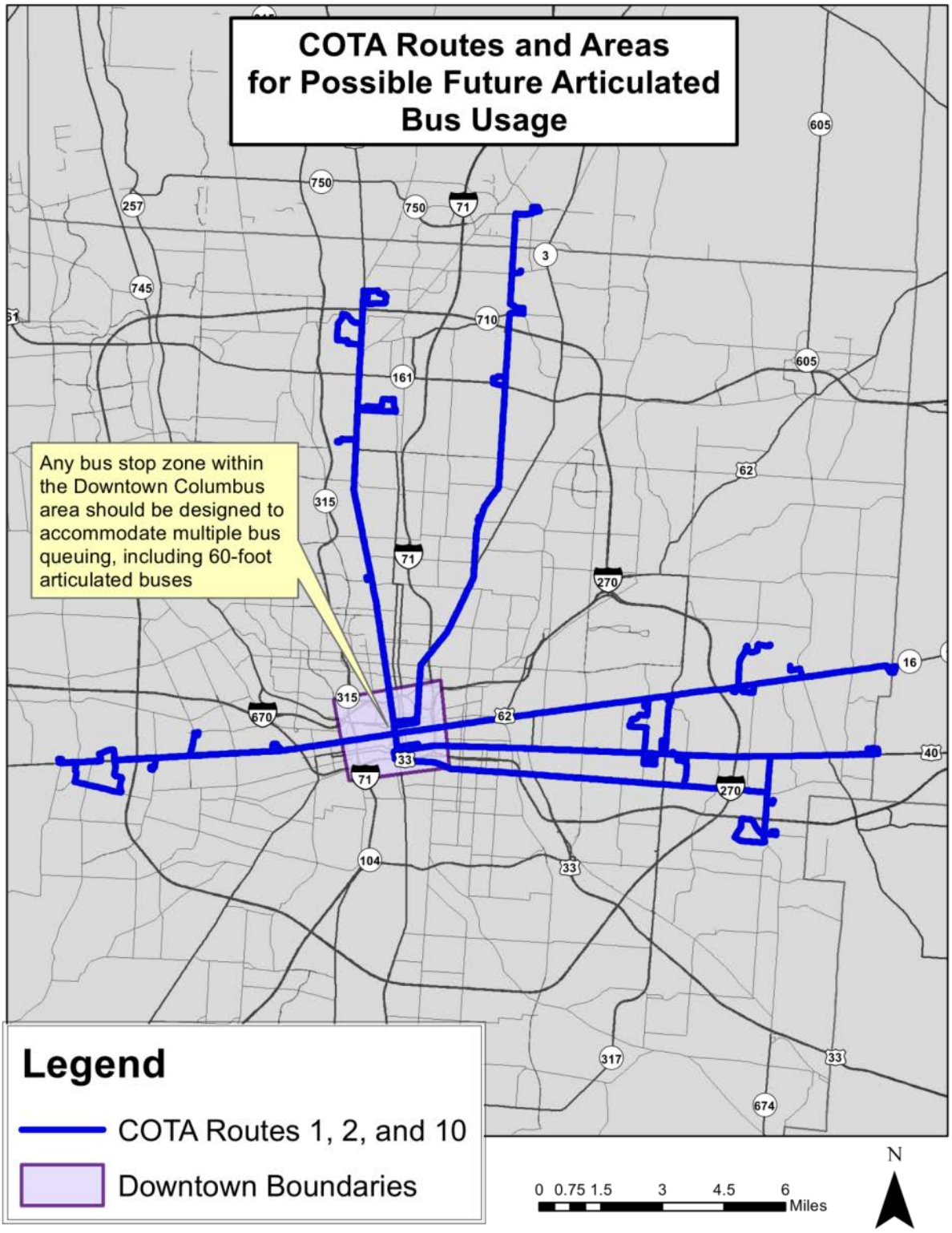


Figure 6-15: Areas Where Bus Stop Zones Should be Designed for Use by Articulated Buses

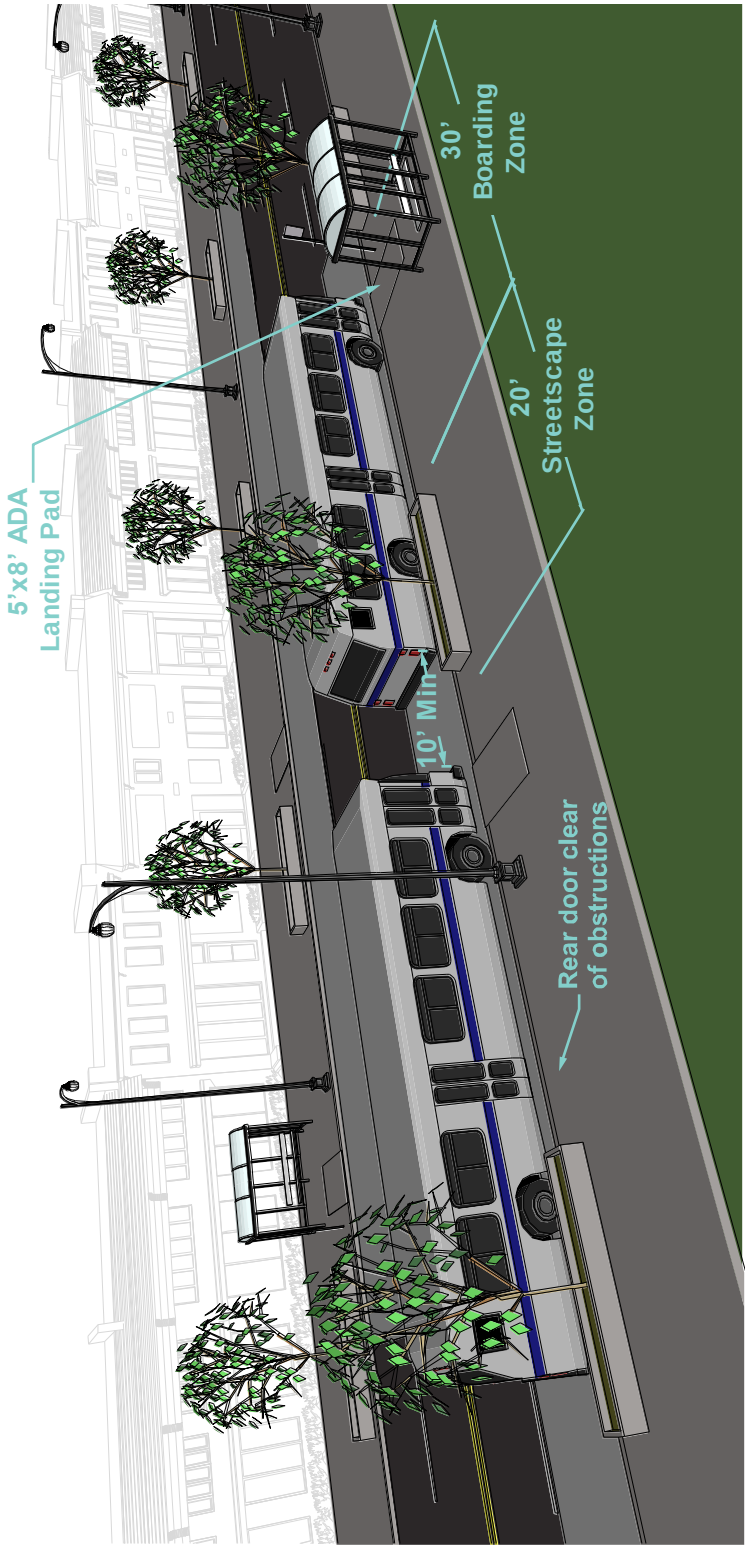


Figure 6-16 Multiple-Bus Zone Configuration for Buses 40 feet and under (full concrete sidewalk)

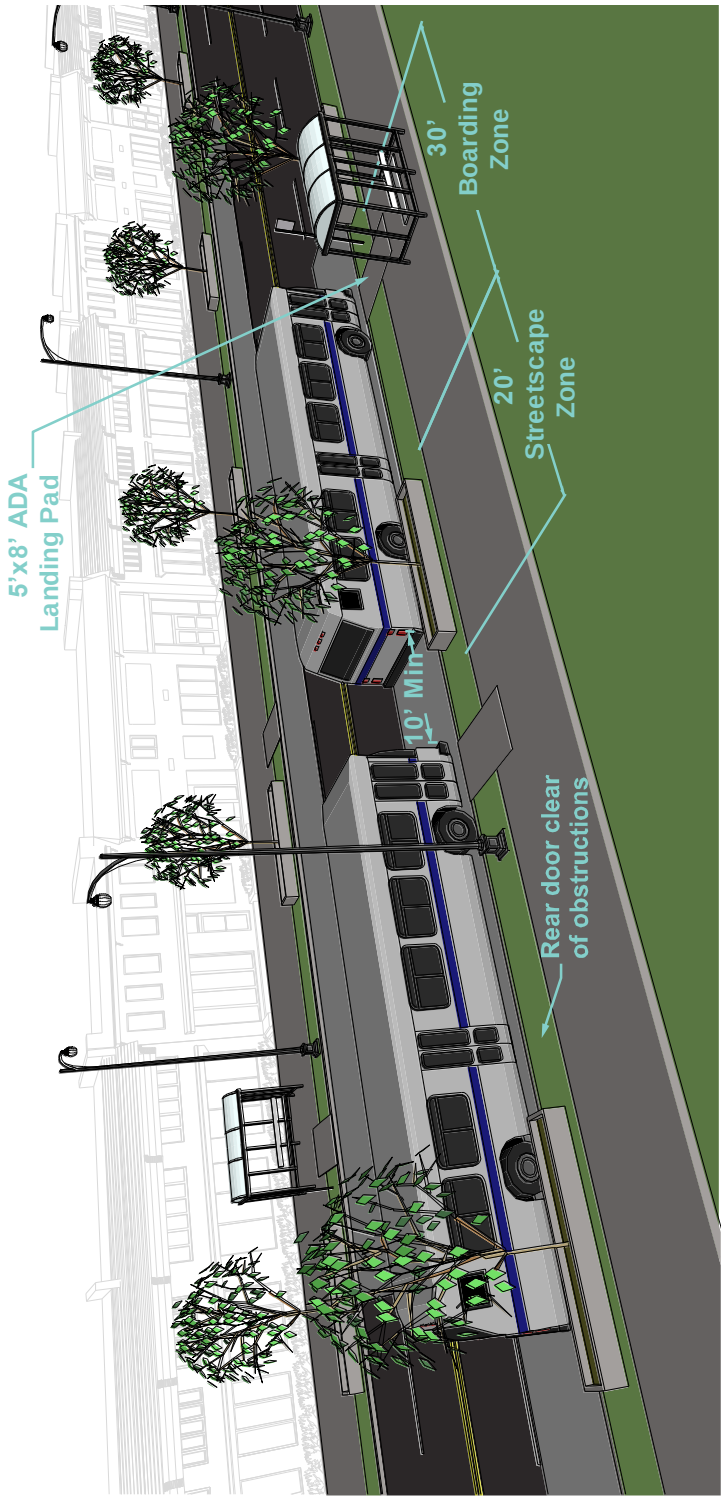


Figure 6-17 Multiple Bus Zone Configuration for Buses 40 feet and under (sidewalk with grassy strip)

Figure 6-18 Multiple Bus Zone to Accommodate Mix of Different Transit Vehicle Dimensions

As illustrated in the drawings above, street trees, landscaping, benches, etc. can be placed in the clear zone if necessary, but they should be placed in a manner that allows operators to safely maneuver the bus and allow passengers to alight in a flat, stable location in the bus stop zone. For example, the picture below (Figure 6-19) shows a situation in which bio-swales were installed as a streetscaping feature in the bus stop zone. While such features are beneficial for enhancing the streetscape, in this particular case they pose a danger to passengers alighting from the rear door of the bus. Large features such as these bio-swales generally should not be installed within the 30-foot pedestrian clear zone. If these types of features are installed, the clear zone guidance presented in the drawings above should be used. Developers are asked to contact COTA at the earliest phases of design so that COTA can advise on the placement of objects inside the pedestrian clear zone.

Figure 6-19 Bio-Swale Placed in Bus Passenger Alighting Area

6.3 Dedicated Bus Facilities

In some situations—such as bus layover locations, areas with high ridership, high pedestrian activity, heavy vehicle traffic, and/or special populations—dedicated bus facilities may be preferable to typical curbside bus stops. These dedicated bus facilities can include bus bays (or turnouts), bus bulbs (or curb extensions/nubs), and bus turnarounds. On roadways with high vehicle volumes and/or speeds (> 35 mph), COTA may request the installation of bus bays or other dedicated bus facilities. Bus bays are not common in the COTA service area, and planning for bus bay construction should always be coordinated with COTA and the municipality.

Bus bays are areas that are cut out of the roadway so that a bus can pull out of the traffic lane and passengers may board and alight safely. These facilities require additional right-of-way acquisition and should always be coordinated with enhanced pedestrian facilities. Figure 6-21 below shows an example of a desirable bus bay with pedestrian amenities, while Figure 6-20 shows an undesirable bus bay design that does not include any pedestrian facilities.

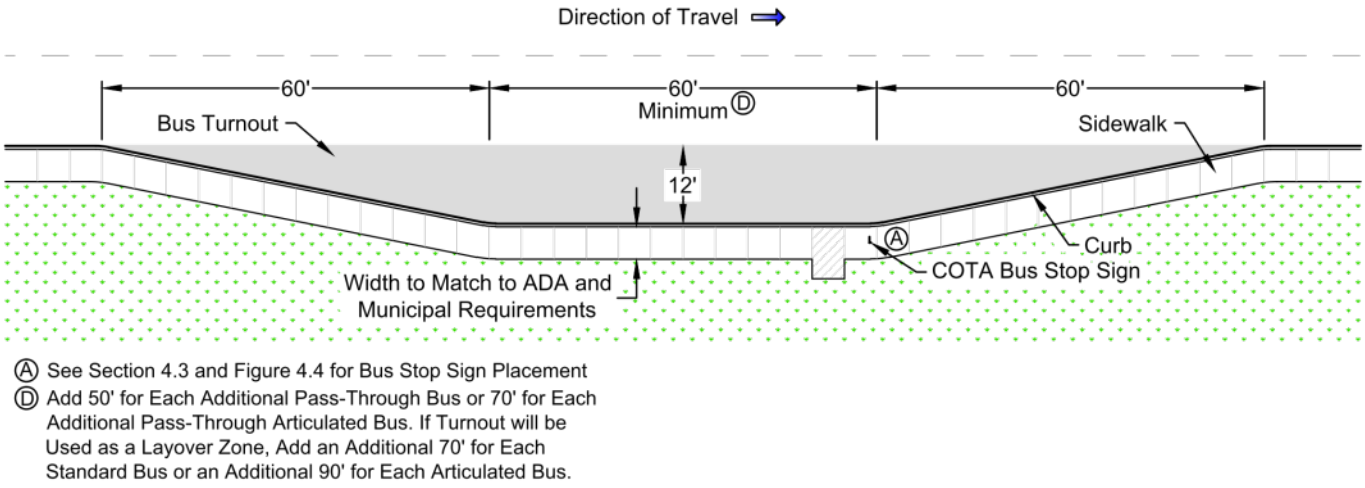
Figure 6-20 Undesirable Bus Bay Design without Pedestrian Features

Figure 6-21 Recommended Bus Bay Design with ADA-Compliant Pedestrian Features

While bus bays are more commonly recommended for roadways with speed limits of 35 mph or above, bus bays can also be useful on lower-speed roads when they will be used as a layover location or otherwise provide a place for buses to dwell for a longer period of time. COTA recommends two different approaches for constructing bus bays depending on what type of roadway they will be built on. Figures 6-22 and 6-23 show mid-block and far-side bus bay designs intended for roadways with speed limits of 35 mph or less. These designs would be most useful for bus stops on lower-speed, lower-volume roads where buses are expected to have a longer dwell time due to heavy passenger activity or the presence of a layover location.

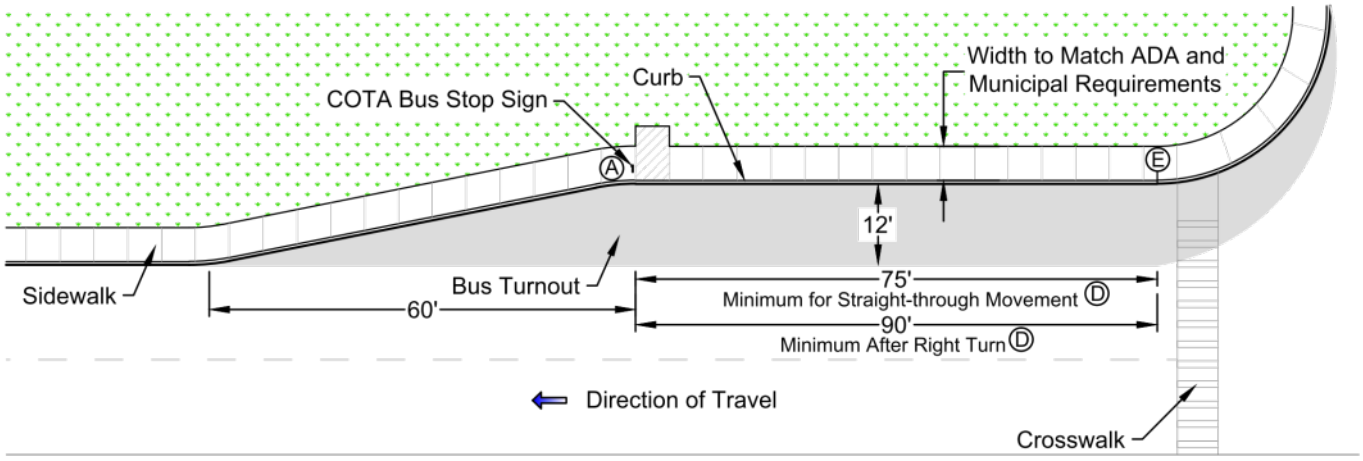
Figure 6-24, on the other hand, shows the design and dimensions of bus bays intended for construction on roadways with a speed limit of 35 mph or greater. This type of bus bay design, described in the Transit Cooperative Research Program Report 19, is well suited for higher-speed, higher-volume roadways where long entrance and exit tapers should be provided so that the bus can achieve both deceleration and acceleration outside of the through-traffic lane. These bus bays are designed to provide minimal interruption to through-traffic on a busy road, and the dimensions vary with the speed limit of the roadway.

While bus bays often decrease potential bus/vehicle conflicts, they can also pose great difficulty for bus operators when attempting to re-enter the traffic stream. Because of this, bus bays are only recommended at far-side locations, locations with transit signal priority, or other locations where periodic breaks in the traffic stream can be expected. Note that COTA does not recommend the installation of nearside bus bays in its service area. These types of facilities work best as “queue-jumpers” for transit vehicles but require significant coordination with traffic signals and enforcement. Because bus bays can pose operational difficulties for COTA’s transit service, developers must discuss the possibility of bus bay construction with COTA at the earliest planning phases of a project.



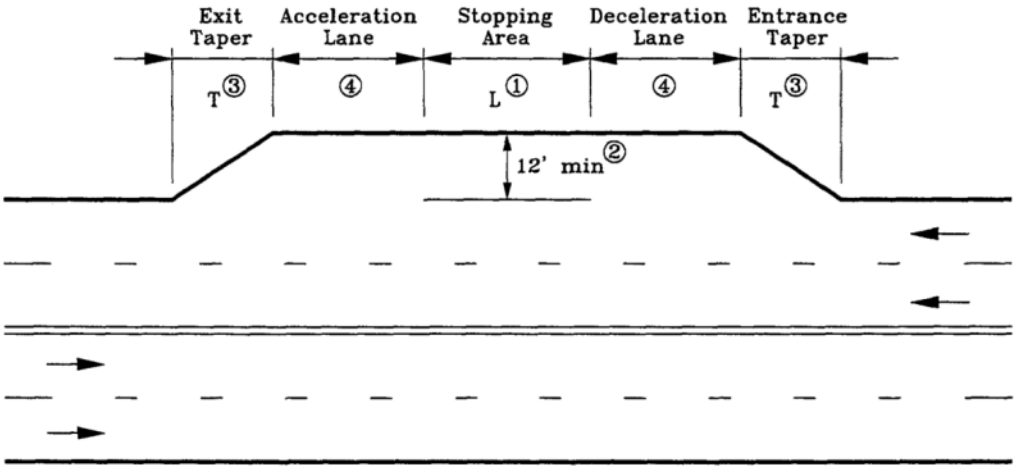
Ⓐ See Section 4.3 and Figure 4.4 for Bus Stop Sign Placement
Ⓓ Add 50' for Each Additional Pass-Through Bus or 70' for Each Additional Pass-Through Articulated Bus. If Turnout will be Used as a Layover Zone, Add an Additional 70' for Each Standard Bus or an Additional 90' for Each Articulated Bus.

Figure 6-22 Typical Mid-Block Bus Bay Design Recommended for Roadways with Speed Limits of 35 mph or Less



Ⓐ See Section 4.3 and Figure 4.4 for Bus Stop Sign Placement
Ⓓ Add 50' for Each Additional Pass-Through Bus or 70' for Each Additional Pass-Through Articulated Bus. If Turnout will be Used as a Layover Zone, Add an Additional 70' for Each Standard Bus or an Additional 90' for Each Articulated Bus.
Ⓔ Bus Berth Dimensions Measured from End of Curb Radius

Figure 6-23 Typical Far-side Bus Bay Design Recommended for Roadways with Speed Limits of 35 mph or Less



Notes:

1) Stopping area length consists of 50 feet for each standard 40-foot bus and 70 feet for each 60-foot articulated bus expected to be at the stop simultaneously. See Table 3 for the suggested bus stop capacity requirements based on a range of bus flow rates and passenger service times.
2) Bus bay width is desirably 12 feet. For traffic speeds under 30 mph, a 10-foot minimum bay width is acceptable. These dimensions do not include gutter width.
3) Suggested taper lengths are listed in table below. Desirable taper length is equal to the major road through speed multiplied by the width of the turnout bay. A taper of 5:1 is a desirable minimum for an entrance taper to an arterial street bus bay while the merging or re-entry taper should not be sharper than 3:1.
4) Minimum design for a busy bay does not include acceleration or deceleration lanes. Recommended acceleration and deceleration lengths are listed in the table below.

Through Speed (mph)	Entering Speed[a] (mph)	Length of Acceleration Lane (Feet)	Length of Deceleration Lane[b] (Feet)	Length of Taper (Feet)
35	25	250	184	170
40	30	400	265	190
45	35	700	360	210
50	40	975	470	230
55	45	1400	595	250
60	50	1900	735	270

[a] Bus speed at end of taper, desirable for buses to be within 10 mph of travel lane vehicle speed at the end of the taper.
[b] Based on 2.5 mph/sec deceleration rate.

Figure 6-24 Bus Bay Design for High-Speed Roadways
Source: TCRP Report No. 19

Bus bulbs do not remove the stopped bus from the lane of traffic, but these facilities are beneficial for areas where preserving on-street parking is an important goal. Bus bulbs are essentially curb extensions, whereby the passenger waiting area extends into the parking lane and the bus does not have to leave and re-enter the traffic lanes, thereby reducing running times for buses and improving schedule adherence. This type of bus stop design provides more room for passenger amenities in high-pedestrian traffic areas, and if the bus bulb extends to the intersection, it reduces pedestrian crossing distances. However, bus bulbs are not particularly suitable for areas with high traffic volumes and only one through-traffic lane, where the bus will block through-traffic long enough to create problems. Figure 6-25 shows the typical layout of bus bulbs.

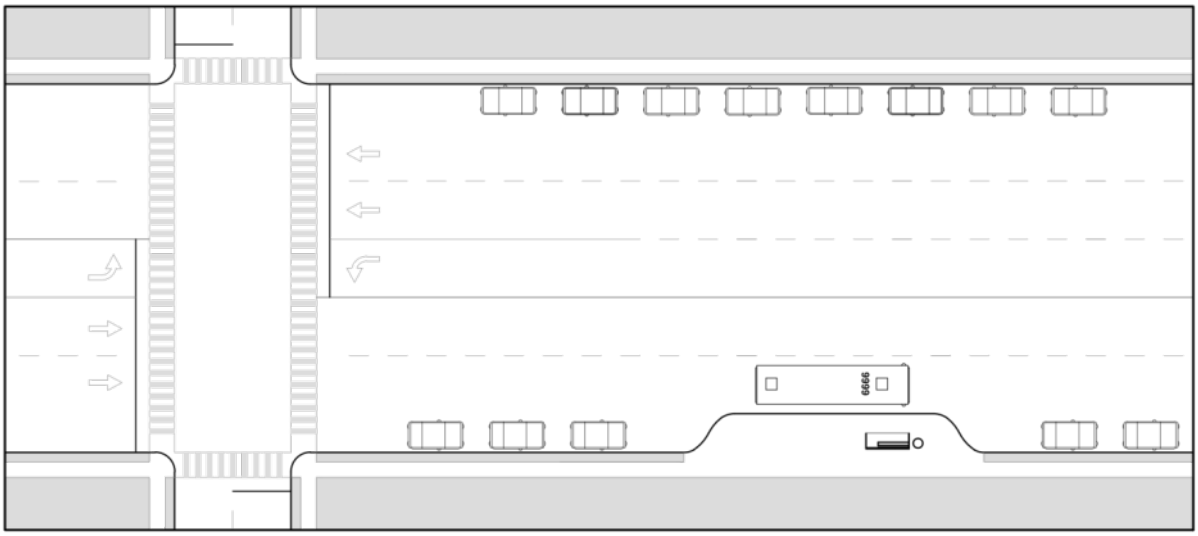


Figure 6-25 Typical Bus Bulb Layout

Dedicated facilities for buses needing to turn around at the end of a route are especially useful for locations served by several routes or buses. Dedicated bus turnarounds should be constructed from higher quality materials to withstand repetitive heavy vehicle usage. These types of turnarounds are usually preferable to the use of commercial lots or loop-routes on existing roads with low ridership. Bus turnarounds can take many forms, a few of which are illustrated in Figure 6-26. Bus turnarounds should provide adequate room for turning, as discussed in the "Turning Radius" section above, and meet all applicable federal, state, and local guidelines.

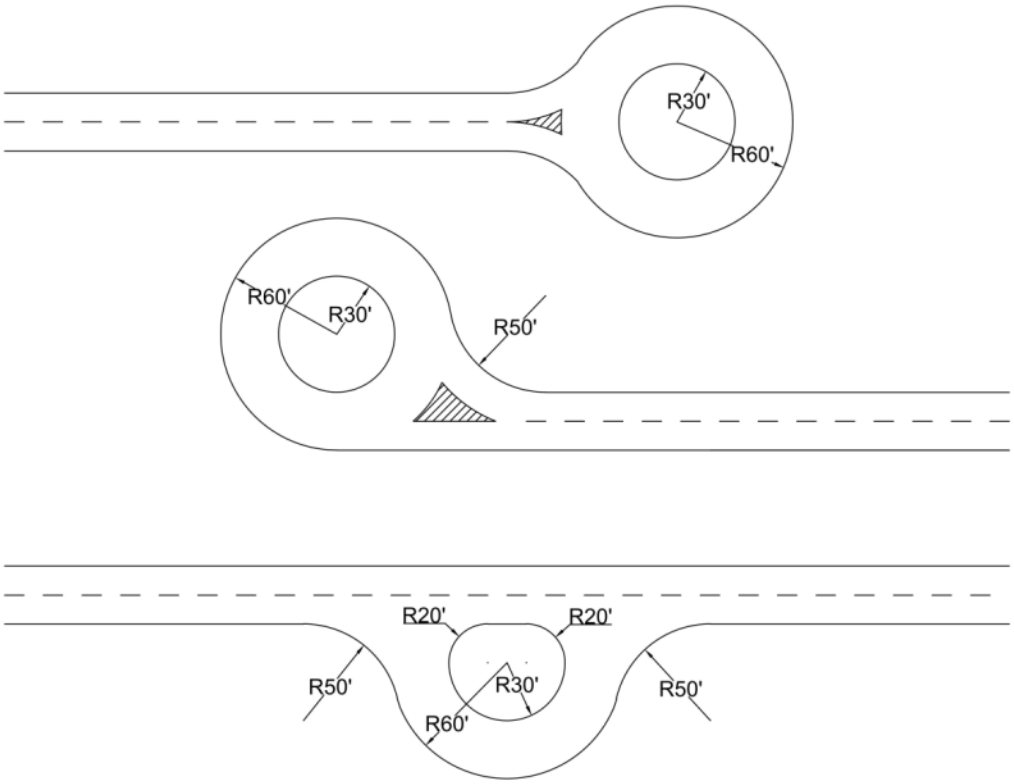


Figure 6-26 Example Bus Turnaround Designs

7 Transit-Friendly Design

The land use and transportation system patterns of a city or neighborhood strongly affect the efficiency and viability of public transportation. In general, the two main factors that affect the level of service of public transportation to an area and its population are pedestrian accessibility and development density. Pedestrian accessibility is important because every transit rider is also a pedestrian. Most trips to and from the transit stop are made by foot, and thus sidewalks and other pedestrian amenities are essential to completing trips by transit. This is especially true for certain segments of the population, such as the elderly and persons with disabilities, who rely on quality pedestrian infrastructure for mobility. The quality of pedestrian access is driven by two factors: the directness and continuity of the sidewalk network and the proximity of the buildings to that sidewalk network.

Development density is also important for the success of public transportation because public transportation is, by definition, designed to transport large numbers of people from one general location to another. To be cost-efficient and provide an adequate level of service, transit must be able to reach relatively large concentrations of people. This does not mean that very high density development (such as downtown Manhattan) is required for successful public transportation. Medium-density residential developments and commercial developments with strong activity centers are sufficient to support convenient transit service with high ridership potential. Additionally, lack of density can be offset in some instances with the use of park & ride lots and other unique services tailored for specific applications.

In a more general sense, transit-friendly design can be accomplished by following “complete streets” principles when designing internal and external transportation systems. The Mid-Ohio Regional Planning Commission’s Complete Streets Toolkit is an excellent resource for learning about and implementing complete streets principles. The toolkit can be found online at www.morpc.org/completestreets

New developments of any size can contribute greatly to the efficiency and effectiveness of public transit in the Central Ohio region. The following eight design principles should be considered in all new and retrofit developments (adapted from Calgary Transit’s “Transit Friendly Design Guide”):

- Provide Appropriate Densities: As mentioned previously, population and employment densities affect the frequency and span of transit service that can be provided reasonably and cost-effectively.
- Minimize Walking Distances: Most people prefer not to walk farther than ¼ of a mile to access a transit stop from their origin or destination. Street layouts and pedestrian pathways should be designed to minimize walking distances to the extent possible. In some instances, pedestrian cut-through paths may be a solution where street

layouts prohibit direct pedestrian access between transit stops and an origin or destination (See Figure 7-2).

- Provide Mixed Land Uses: A mix of uses and activities clustered in one area or along a corridor allows for greater travel options and the ability to combine trip purposes (i.e. stopping for groceries on the way home from work).
- Organize Density, Land Use, and Buildings to Benefit from Transit: Site layout should be organized to create convenient pedestrian movements and access to transit. For example, housing developments should cluster the majority of the population around a location accessible to transit, and commercial developments should front the roadway rather than a parking lot to provide convenient pedestrian access to the street and transit stops (See Figures 7-1 and 7-3).
- Create a Pedestrian-Friendly Environment: As mentioned above, most transit riders begin and end their trips on foot, and thus good-quality, safe, and direct pedestrian routes are essential to easily access transit. Pedestrian-friendly environments are especially important for persons with disabilities and the elderly, who rely heavily on safe access to transit service. Furthermore, the entire community benefits from an effective pedestrian environment, whether or not they use the transit service.
- Route Transit into the Community: Housing developments, shopping centers, and business parks are frequently developed with little to no regard for transit. This often results in circuitous access within the developments that are prohibitive to efficient transit service. The layout of such developments should take transit into account in the early design phases so that transit routes will be able to better serve the residents, customers, and employees of these developments (see Figure 7-4).
- Reduce Transit Travel Time: People are very sensitive to total trip times, including the time to access transit and the time in the transit vehicle itself. Street development patterns should emphasize directness and connectivity to benefit transit vehicles as well as pedestrians. In certain situations, dedicated transit (or high-occupancy vehicle) travel lanes can also be implemented to reduce transit travel times.
- Build Quality, User-Friendly Transit Facilities: Transit will always be in competition with the personal automobile. Thus, transit facilities (such as bus shelters, passenger waiting areas, and transit centers) must be designed and built with as much care and quality as automobile facilities. Transit facilities (and thus pedestrian facilities) should be planned for and integrated into the earliest stages of project development and treated as a normal project cost.

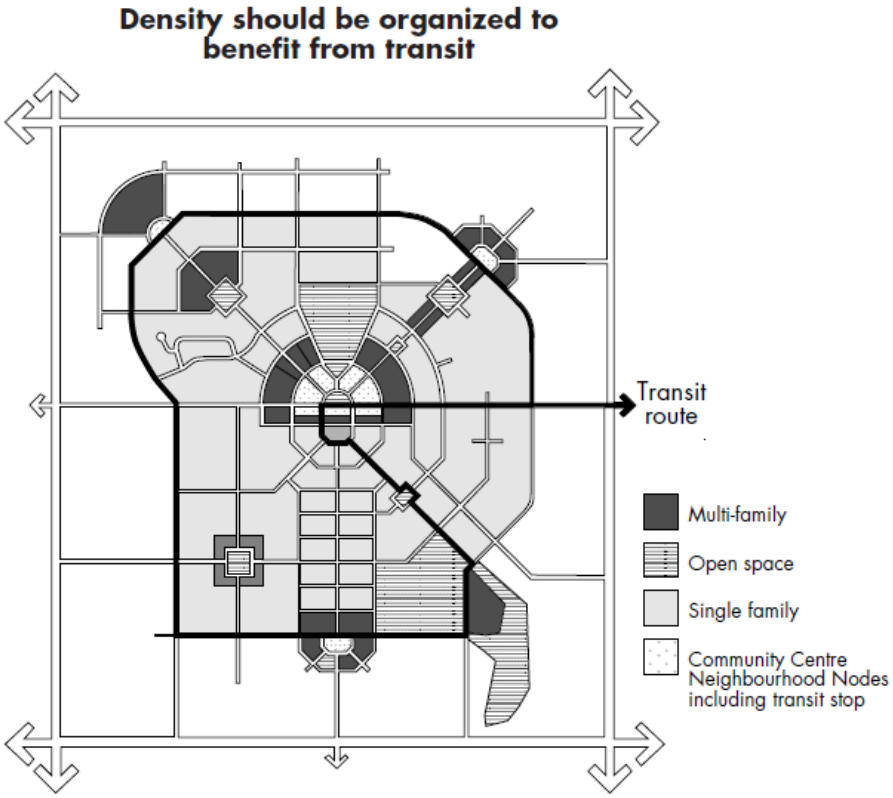


Figure 7-1 Transit and Density
Source: Transit Friendly Design Guide. Calgary Transit, 1996

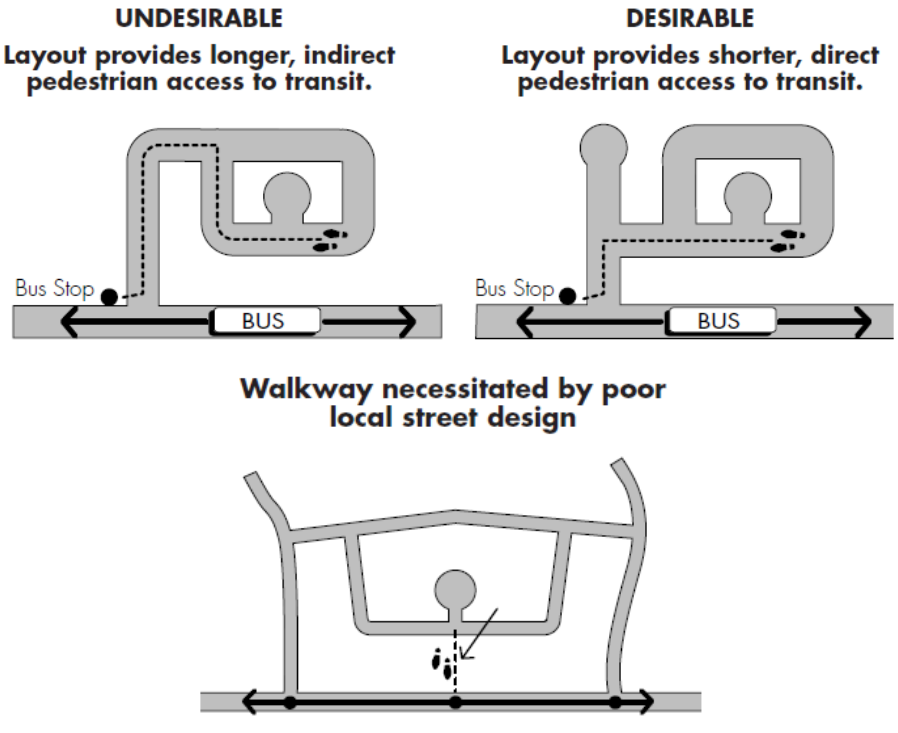


Figure 7-2 Transit-Friendly Street Design
Source: Transit Friendly Design Guide. Calgary Transit, 1996

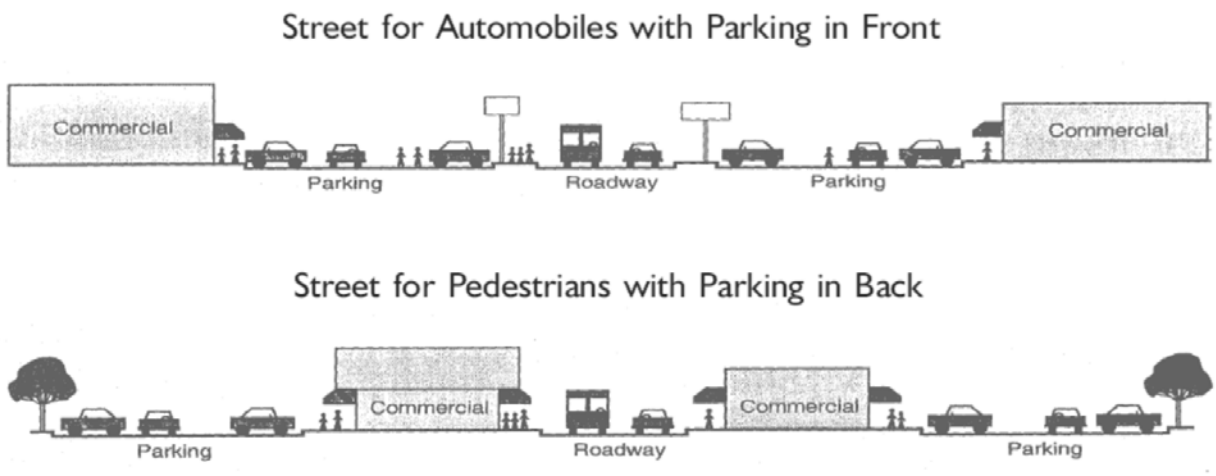


Figure 7-3 Setbacks and Parking

Source: Pedestrian- and Transit-Friendly Design: A Primer for Smart Growth. Reid Ewing, 1999.

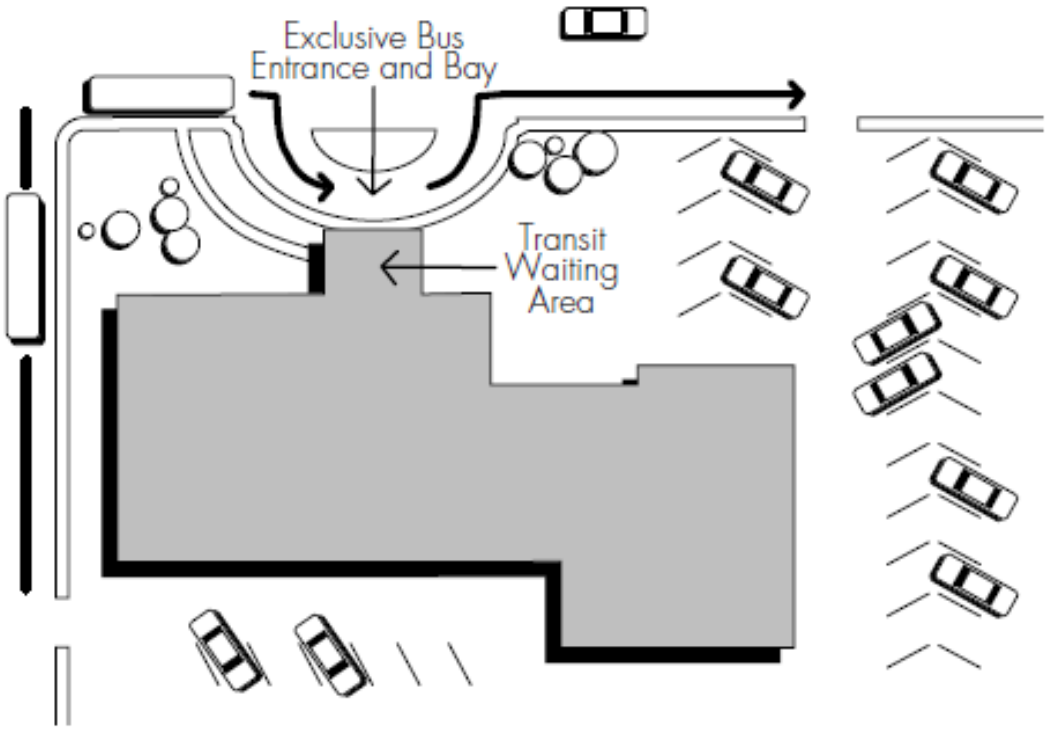


Figure 7-4 Good Transit Access to Shopping Center

Source: Transit Friendly Design Guide. Calgary Transit, 1995.

7.1 Transit-Oriented Development (TOD)

Transit-Oriented Development (TOD) is aimed at providing conditions that are beneficial to patrons (to use transit) as well as transit agencies (to provide transit service). As the Center for Transit-Oriented Development notes, "Transit-oriented development is often defined as higher-density mixed-use development within walking distance – or a half mile – of transit stations." TOD also provides superior walking and bicycling facilities so that residents can easily travel between their homes, shopping, work, and transit stations. Overall, TOD is intended to create more vibrant and convenient communities for people to live and work, where car ownership is not a necessity and household transportation costs can be kept low. TOD's also often provide affordable housing opportunities that are supported by lowered household transportation costs. The Mid-Ohio Regional Planning Commission's *Complete Streets Toolkit* contains a section on Transit-Oriented Development that can be found at http://www.morpc.org/trans/CS_Toolkit_9_TOD.pdf

In a broad sense, well-planned and coordinated transit-oriented development can be beneficial for all parties involved: residents, business-owners, developers, transit agencies, and the surrounding community. The economic development benefits of TOD have been well-documented, but social and environmental benefits often result as well. According to the Federal Transit Administration, "The most direct benefit of TOD [to transit agencies]…is increased ridership and the associated revenue gains. Other primary benefits include the vitalization of neighborhoods, financial gains for joint development opportunities, increases in the supply of affordable housing, and profits to those who own land and businesses near transit stops. Secondary benefits include congestion relief, land conservation, reduced outlays for roads, and improved safety for pedestrians and cyclists." (http://fta.dot.gov/about_FTA_6932.html). Transit-Oriented Development has not yet been heavily pursued in the Central Ohio region, but COTA strongly supports this concept and will work with local governments, developers, and other agencies to support such opportunities in the future.

8 Public Involvement Concerning Bus Stops

COTA strives to keep customers well-informed of any changes that will affect service, including changes to bus stops. COTA may remove bus stops for a number of reasons including better alignment with bus stop spacing guidelines, route realignments, safety issues, construction projects, or changes in land use. Bus stop movement or removal may or may not occur in conjunction with one of COTA's regular service changes (in January, May, and September) depending on the situation. When possible, it is COTA's policy to post Commuter Bulletins on all bus stops that are to be removed or have a major change in service prior to the change taking effect. Commuter Bulletins are notices explaining the service change, including a map and contact information for COTA customer service.

In situations where COTA has the ability to control the movement or removal of a bus stop, COTA seeks additional public input concerning bus stop changes and will post a round of bulletins several months before the change and again when a final decision is made. COTA also strives to notify the public about proposed and final bus stop changes at public meetings and through information posted on our website.

COTA welcomes input from the public about bus stops. All comments or concerns—including requests for new stops, requests for shelters or other amenities, concerns about bus stop placement, or feedback about proposed stop removals—should be directed to COTA Customer Service. For most requests, such as requests for trash cans, the feedback will be forwarded to Planning Department staff, who will then use the standards explained in this document to assess the request and respond within 10 business days. Note that a final response to the request may not be received within 10 days if a thorough investigation is needed. However, customers will at least receive a notice that their request has been received within 10 business days of the submittal.

Because of the number of factors involved in decisions about bus stop locations, customer requests to remove, relocate, or add a stop along an existing line will be directed to a form entitled "Request to Add, Remove or Relocate a Bus Stop." This form is currently in development, but will eventually be available as both a webform on COTA's website and a paper form. Once implemented, the Customer Bus Stop Request form will be directed to Planning Department staff, who will assess the request using an internal assessment form. Examples of both of these forms are included in Appendix B. This form summarizes the many issues that must be considered in regards to bus stop placement that are fully detailed in the text of this document, including land use, population density, spacing, setting accessibility, transfer opportunities, ridership, and existing amenities. COTA Planning staff may deem it necessary to take further steps in order to make an appropriate decision, including site investigations, discussions with adjacent property owners, consultations with municipalities, or solicitation of additional public input. COTA staff will then use the information on the assessment form, and any additional information necessary to make a

decision whether to add, remove, or relocate the bus stop. The requestor will be notified of the Planning Department's receipt of their request within 10 business days, though the final decision regarding the request may take more time.

COTA's Customer Care Office contact information is provided below.

Online

http://www.cota.com/Contact-Customer-Support.aspx

By Phone

COTA Customer Service

Mon-Fri 6:00 a.m. to 8:00 p.m.

Sat-Sun 8:00 a.m. to 6:00 p.m.

Holidays 8:00 a.m. to 5:00 p.m.

Ph (614) 228-1776 TTY/TTD (614) 275-5878

Commendations/Complaints (614) 228-1776

In Person

COTA Pass Sales Office, 33 N. High Street, Columbus, Ohio 43215

Mon-Fri 8:00 a.m. to 5:00 p.m.

Ph (614) 228-1776

Appendix A

2006 Department of Transportation ADA Standards for Transportation Facilities

Excerpts Relevant to Bus Stops and Surrounding Areas

(check access-board.gov for most recent standards)

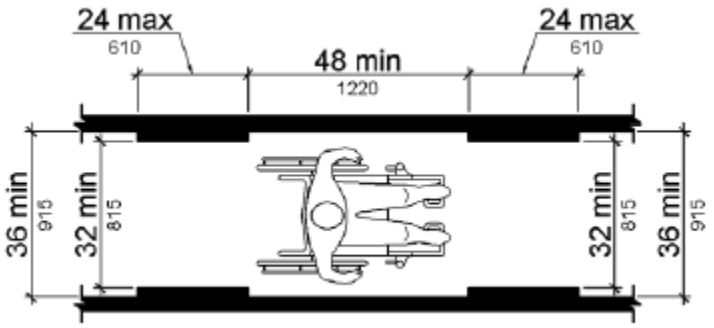
These standards apply to the construction and alteration of transportation facilities covered by the Americans with Disabilities Act (ADA). They became effective November 29, 2006. The Department of Transportation (DOT) adopted these standards based on updated **guidelines** issued by the Board. The standards are consistent with the Board's guidelines except for provisions DOT modified concerning:

- accessible routes (206.3)
- detectable warnings on curb ramps (406.8)
- bus boarding areas (810.2.2), and
- rail station platforms (810.5.3).

402 Accessible Routes

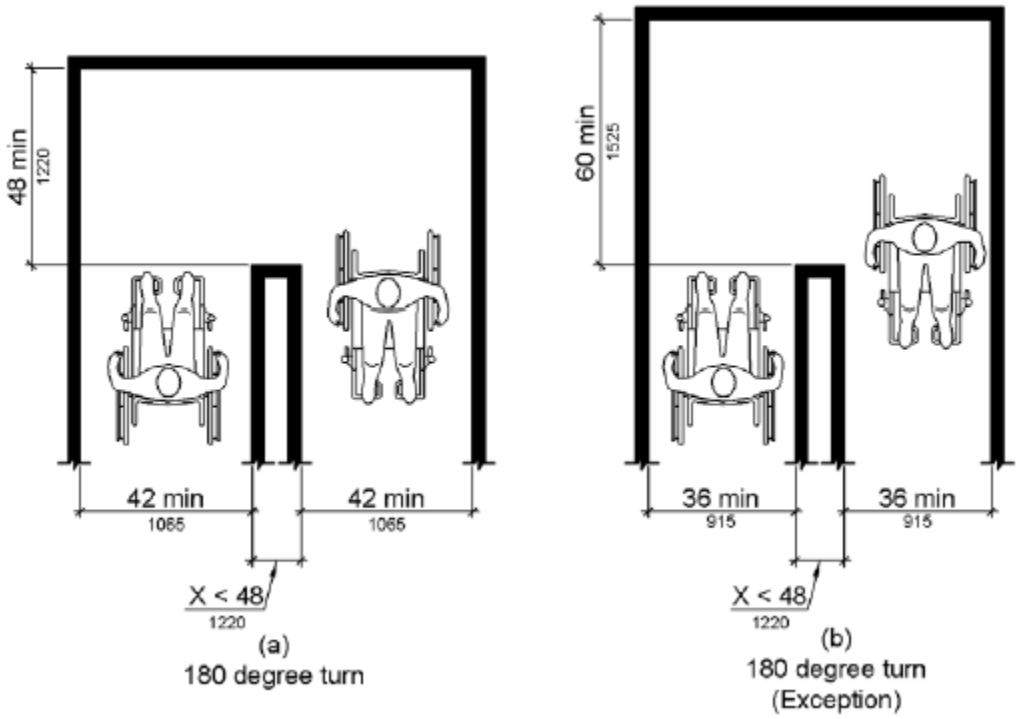
- 402.1 General. Accessible routes shall comply with 402.
- 402.2 Components. Accessible routes shall consist of one or more of the following components: walking surfaces with a running slope not steeper than 1:20, doorways, ramps, curb ramps excluding the flared sides, elevators, and platform lifts. All components of an accessible route shall comply with the applicable requirements of Chapter 4.
- Advisory 402.2 Components. Walking surfaces must have running slopes not steeper than 1:20, see 403.3. Other components of accessible routes, such as ramps (405) and curb ramps (406), are permitted to be more steeply sloped.
- **403 Walking Surfaces**
- 403.1 General. Walking surfaces that are a part of an accessible route shall comply with 403.
- 403.2 Floor or Ground Surface. Floor or ground surfaces shall comply with 302.
- 403.3 Slope. The running slope of walking surfaces shall not be steeper than 1:20. The cross slope of walking surfaces shall not be steeper than 1:48.
- 403.4 Changes in Level. Changes in level shall comply with 303.
- 403.5 Clearances. Walking surfaces shall provide clearances complying with 403.5.
- EXCEPTION: Within employee work areas, clearances on common use circulation paths shall be permitted to be decreased by work area equipment provided that the decrease is essential to the function of the work being performed.
- 403.5.1 Clear Width. Except as provided in 403.5.2 and 403.5.3, the clear width of walking surfaces shall be 36 inches (915 mm) minimum.
- EXCEPTION: The clear width shall be permitted to be reduced to 32 inches (815 mm) minimum for a length of 24 inches (610 mm) maximum provided that reduced width segments are separated by segments that are 48 inches (1220 mm) long minimum and 36 inches (915 mm) wide minimum.

Figure 403.5.1 Clear Width of an Accessible Route



- 403.5.2 Clear Width at Turn. Where the accessible route makes a 180 degree turn around an element which is less than 48 inches (1220 mm) wide, clear width shall be 42 inches (1065 mm) minimum approaching the turn, 48 inches (1220 mm) minimum at the turn and 42 inches (1065 mm) minimum leaving the turn.
- EXCEPTION: Where the clear width at the turn is 60 inches (1525 mm) minimum compliance with 403.5.2 shall not be required.

Figure 403.5.2 Clear Width at Turn



- 403.5.3 Passing Spaces. An accessible route with a clear width less than 60 inches (1525 mm) shall provide passing spaces at intervals of 200 feet (61 m) maximum. Passing spaces shall be either: a space 60 inches (1525 mm) minimum by 60 inches (1525 mm) minimum; or, an intersection of two walking surfaces providing a T-shaped space complying with 304.3.2 where the base and arms of the T-shaped space extend 48 inches (1220 mm) minimum beyond the intersection.
- 403.6 Handrails. Where handrails are provided along walking surfaces with running slopes not steeper than 1:20 they shall comply with 505.
- Advisory 403.6 Handrails. Handrails provided in elevator cabs and platform lifts are not required to comply with the requirements for handrails on walking surfaces.

810 Transportation Facilities

810.1 General. Transportation facilities shall comply with 810.

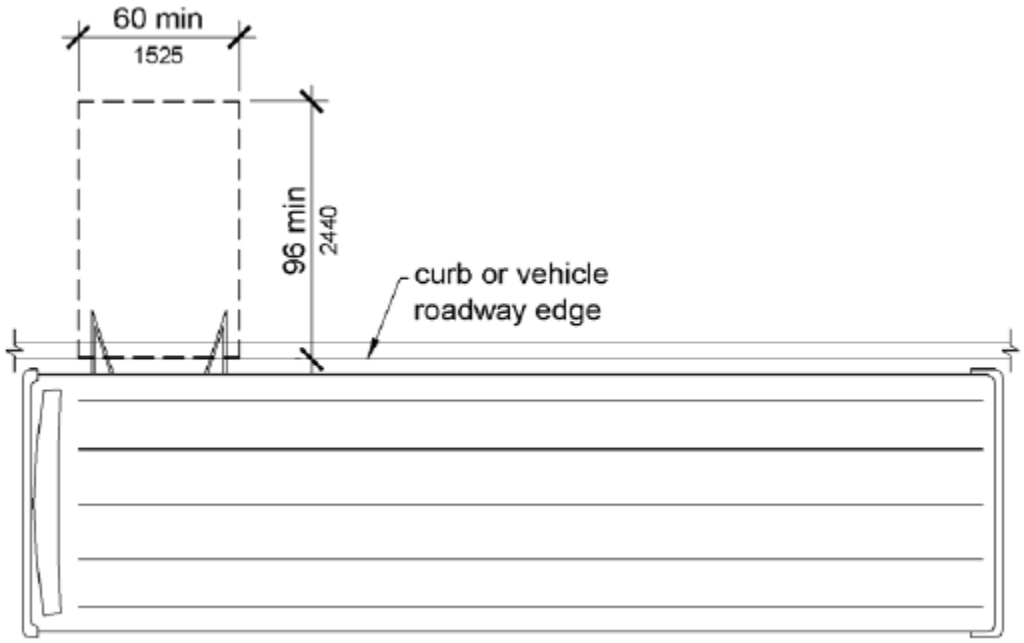
810.2 Bus Boarding and Alighting Areas. Bus boarding and alighting areas shall comply with 810.2.

Advisory 810.2 Bus Boarding and Alighting Areas. At bus stops where a shelter is provided, the bus stop pad can be located either within or outside of the shelter.

810.2.1 Surface. Bus stop boarding and alighting areas shall have a firm, stable surface.

810.2.2 Dimensions. Bus boarding and alighting areas shall provide a clear length of 96 inches (2440 mm), measured perpendicular to the curb or vehicle roadway edge, and a clear width of 60 inches (1525 mm), measured parallel to the vehicle roadway. Public entities shall ensure that the construction of bus boarding and alighting areas comply with 810.2.2, to the extent the construction specifications are within their control.

Figure 810.2.2 Dimensions of Bus Boarding and Alighting Areas

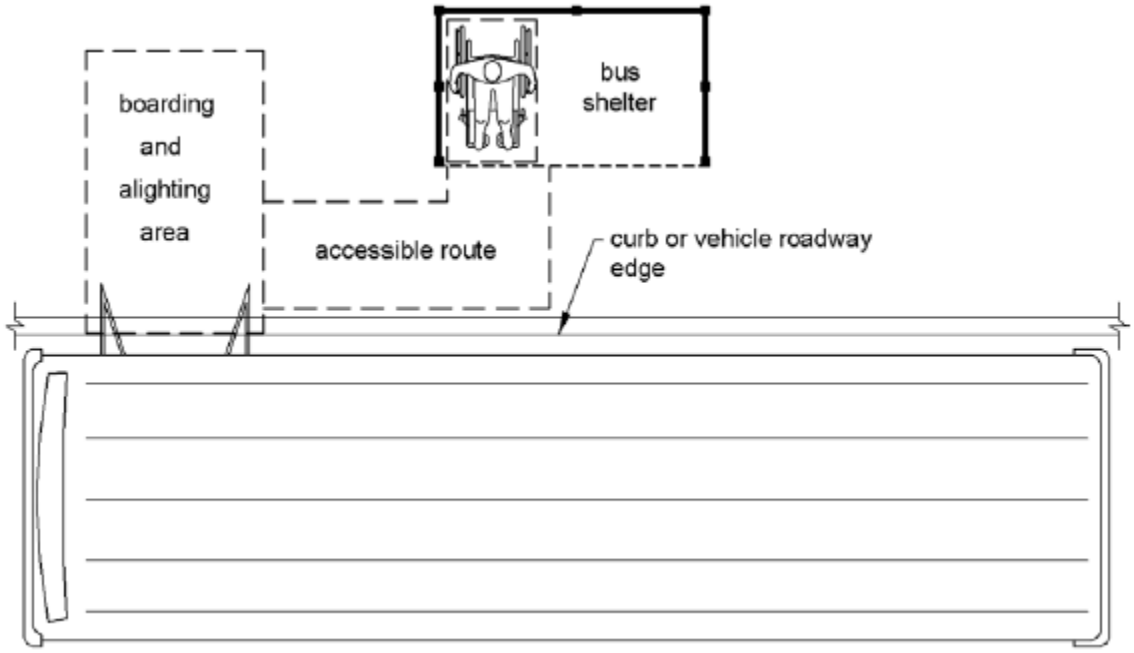


810.2.3 Connection. Bus stop boarding and alighting areas shall be connected to streets, sidewalks, or pedestrian paths by an accessible route complying with 402.

810.2.4 Slope. Parallel to the roadway, the slope of the bus stop boarding and alighting area shall be the same as the roadway, to the maximum extent practicable. Perpendicular to the roadway, the slope of the bus stop boarding and alighting area shall not be steeper than1:48.

810.3 Bus Shelters. Bus shelters shall provide a minimum clear floor or ground space complying with 305 entirely within the shelter. Bus shelters shall be connected by an accessible route complying with 402 to a boarding and alighting area complying with 810.2.

Figure 810.3 Bus Shelters



810.4 Bus Signs. Bus route identification signs shall comply with 703.5.1 through 703.5.4, and 703.5.7 and 703.5.8. In addition, to the maximum extent practicable, bus route identification signs shall comply with 703.5.5.

EXCEPTION: Bus schedules, timetables and maps that are posted at the bus stop or bus bay shall not be required to comply.

810.7 Public Address Systems. Where public address systems convey audible information to the public, the same or equivalent information shall be provided in a visual format.

Appendix B

Forms for Customer Requests Involving Bus Stop Removal, Relocation, or Addition

Request to Add, Remove or Relocate a Bus Stop

--Please fill out form completely and include accurate contact information so that we may respond to your request--

Requestor

Name: _____

Company/Affiliation (if applicable): _____

Address: _____

Phone Number or Email: _____

Date of Request: _____

Request to: ☐ Add ☐ Remove ☐ Relocate

What bus route is the bus stop on? (Please only use this form to request bus stop changes on existing COTA routes)

COTA Bus Route #: _____

Reason for Request (required):

_____
_____
_____

Description of Current Bus Stop Location (if applicable)

Nearest intersection: _____

Direction of travel: ☐ Northbound ☐ Southbound ☐ Eastbound ☐ Westbound

Description of New Bus Stop Location (if applicable)

Nearest intersection: _____

Direction of travel: ☐ Northbound ☐ Southbound ☐ Eastbound ☐ Westbound

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Rev. 2, 9/13/2012

Request to Add, Remove or Relocate a Bus Stop

Thank you for your input. Your request will be reviewed by COTA's Capital Projects and Planning Department using established criteria to make a determination. Bus stop placement is affected by several factors, including:

- Ridership
- Bus Stop Spacing
- Land Use and Population Density
- Existing Conditions in the Right-of-Way
- Important Destinations (such as hospitals, grocery stores, and schools)

After reviewing the above factors and other information, the Planning Department will respond to your request within 10 business days. We will contact you if additional information is necessary.

Rev. 2, 9/13/2012

COTA
CENTRAL OHIO TRANSIT AUTHORITY

Assessment of Bus Stop Requests (Internal Use Only)

Feedback ID#

Requestor
Name: Click here to enter text.
Company/Affiliation: Click here to enter text.
Address: Click here to enter text.
Phone Number or Email: Click here to enter text.
Date of Request: Click here to enter a date.
Reason for Request: Click here to enter text.

Request
Request to: ☐ Add Stop ☐ Remove Stop ☐ Relocate Stop
☐ Install Shelter ☐ Install Trash Receptacle (go to page 3)
Stop ID (if existing): Click here to enter text.

Description of Current Bus Stop Location (if applicable)
Nearest intersection: Click here to enter text.
Direction of travel: ☐ Northbound ☐ Southbound ☐ Eastbound ☐ Westbound
Placement: ☐Nearside ☐Farside ☐Midblock

Description of Requested Bus Stop Location (if applicable)
Nearest intersection: Click here to enter text.
Direction of travel: ☐ Northbound ☐ Southbound ☐ Eastbound ☐ Westbound
Placement: ☐Nearside ☐Farside ☐Midblock

Existing Location Land Use/Density (if applicable)
Surrounding land use: ☐Residential ☐Office ☐Education ☐Retail ☐Park ☐Mixed
☐Central business district ☐Other, Describe: Click here to enter text.
Density (If residential): Click here to enter text.

Requested Location Land Use/Density (if applicable)
Surrounding land use: ☐Residential ☐Office ☐Education ☐Retail ☐Park ☐Mixed
☐Central business district ☐Other, Describe: Click here to enter text.
Density (If residential): Click here to enter text.

Appropriate COTA Spacing Standard
☐ 500-700 ft. – High residential density (>20 persons/acre), retail, central business district
☐ 700-850 ft. – Fully developed residential area (10-20 persons/acre)
☐ 850-1200 ft. – Low density residential area (3-10 persons/acre)
☐ 1200 ft. or more – Rural, or express bus service (0-3 persons/acre)

1

COTA
CENTRAL OHIO TRANSIT AUTHORITY

Assessment of Bus Stop Requests (Internal Use Only)

Existing Spacing (if applicable)
Primary Line Serving Stop: Click here to enter text.
Feet from previous stop: Click here to enter text.
Consistent with spacing standard: ☐ Yes ☐ No
Feet to next stop: Click here to enter text.
Consistent with spacing standard: ☐ Yes ☐ No
Secondary Line Serving Stop: Click here to enter text.
Feet from previous stop: Click here to enter text.
Consistent with spacing standard: ☐ Yes ☐ No
Feet to next stop: Click here to enter text.
Consistent with spacing standard: ☐ Yes ☐ No

Spacing if Request is implemented
Primary Line Serving Stop: Click here to enter text.
Feet from previous stop: Click here to enter text.
Consistent with spacing standard: ☐ Yes ☐ No
Feet to next stop: Click here to enter text.
Consistent with spacing standard: ☐ Yes ☐ No
Secondary Line Serving Stop: Click here to enter text.
Feet from previous stop: Click here to enter text.
Consistent with spacing standard: ☐ Yes ☐ No
Feet to next stop: Click here to enter text.
Consistent with spacing standard: ☐ Yes ☐ No

Existing Setting (if applicable)
Street Type: ☐Local ☐Collector ☐Arterial
Number of lanes: Click here to enter text.
Nearby sensitive land uses: Click here to enter text.
Nearby major destinations: Click here to enter text.
Description of other unique site characteristics:

Requested Setting (if applicable)
Street Type: ☐Local ☐Collector ☐Arterial
Number of lanes:
Nearby sensitive land uses:
Nearby major destinations:
Description of other unique site characteristics:

Existing Location Accessibility (if applicable)
Sidewalks to/from stop location ☐Yes ☐No ☐Partial
Curb ramps at closest intersection ☐Yes, all corners ☐ No ☐Partial

2

Assessment of Bus Stop Requests (Internal Use Only)

Crosswalk or traffic controlled intersection ☐Yes ☐No

Requested Location Accessibility (if applicable)
Sidewalks to/from stop location ☐Yes ☐No ☐Partial
Curb ramps at closest intersection ☐Yes, all corners ☐ No ☐Partial
Crosswalk or traffic controlled intersection ☐Yes ☐No

Existing Location Transfers (if applicable)
If transfer point, are there other locations where transfer can occur?
☐Yes ☐No
If Yes, Location: Click here to enter text.

Requested Location Transfers (if applicable)
If transfer point, are there other locations where transfer can occur?
☐Yes ☐No
If Yes, Location: Click here to enter text.

Ridership (if existing)
Average weekday boardings: Click here to enter text.
Average weekday alightings: Click here to enter text.

Amenities (if existing)
☐Shelter ☐ ADA Landing Pad ☐Trash Receptacle ☐Lighting ☐Bike Rack
☐ Reinforced pad in roadway ☐Other, describe: Click here to enter text.

Trash Receptacle Request
Is the stop at a driver recovery location and/or a bus shelter? ☐ Yes ☐ No
Does the stop have existing ridership of 25 or more per day? ☐Yes ☐No
Is the stop near a restaurant/food establishment? ☐ Yes ☐ No
How many previous trash receptacle requests have been received for this stop? Click here to enter text.

Bus Shelter Request
Does the location meet COTA's boarding requirements? ☐ Yes ☐ No
Do existing conditions permit shelter installation (i.e. ROW, sidewalks)? ☐ Yes ☐ No
Is there an existing bus shelter at a nearby stop? ☐ Yes ☐ No

---

3

COTA
CENTRAL OHIO TRANSIT AUTHORITY

Assessment of Bus Stop Requests (Internal Use Only)

Assessment: ☐Request Approved ☐Request Denied
Description of Reasoning for Assessment: Click here to enter text.

Assessor Name: Click here to enter text.

Date of Assessment: Click here to enter a date.

4